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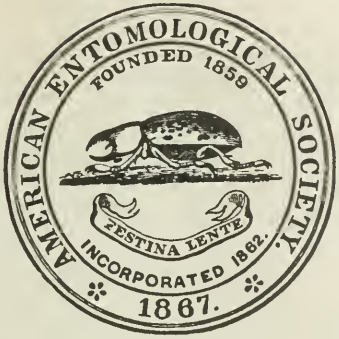


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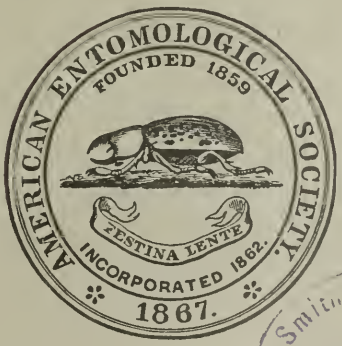


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VOLUME XLIII

# REVISION OF THE THROSCIDAE OF NORTH AMERICA (COLEOPTERA)

BY FREDERICK BLANCHARD

[In offering the following treatment of our species of Throscidae, a few words should be said by way of introduction. The manuscript was written by Mr. Blanchard some ten years ago, but was never quite finished, there being certain obscure or doubtful points concerning which he hoped to obtain further information. The desired light, however, was not forthcoming, the borrowed material was returned, other interests supervened and the manuscript was laid aside, and apparently received little if any further attention. On my next visit to New England after Mr. Blanchard's death in November, 1912, this manuscript together with all his other miscellaneous entomological notes were, in accordance with his own request, turned over to me. Although essentially completed, in that the characterizations of the genera, tables of species and specific descriptions had been written, still no final draft had been prepared for the printer, and considerable labor has been required in arranging, correcting, copying, etc., etc. This work has been cheerfully if somewhat tardily done, in order that the time and effort expended by its author shall not have been wasted, and that one more paper may be added to the altogether too few which we have from one whom I have no hesitation in pronouncing one of the keenest, if not the keenest, and most competent of all the students of our Coleoptera.

That Blanchard made so few contributions to systematic Coleopterology is due largely to two causes. First, because so large a share of his leisure was devoted to the interests of his numerous entomological correspondents, and again because of his unwillingness to publish anything without having acquired complete and exhaustive information on the subject. How nearly impossible of attainment is this latter condition, is well known to anyone who has attempted to prepare a review of even a very small group of our Coleoptera. The desire for thoroughness, therefore, however laudable up to a certain point, results, if carried to extremes, in depriving us even of the half loaf, which is certainly better than no bread.

In the following pages everything is to be accredited to the author of the manuscript, except such statements as are enclosed in brackets or placed as footnotes. No bibliography was prepared by Mr. Blanchard. For such, consult Horn's paper[1] for the older species. The others are for the first time described in the present paper, except a small number by Mr. Schaeffer, which appeared in the Bulletin of the Brooklyn Entomological Society.[2] H. C. Fall.]

Linnaeus, in 1767, described *Elater dermestoides*, which was later (1796) made the basis for Latreille's genus *Throscus*. There has been more or less discussion as to the systematic position of the genus and its associates ever since; Lacordaire, Bonvouloir and LeConte ranking the group as a family, while later writers consider that it forms a subfamily of the Elateridae, returning to the Linnaean conception, and Dr. Horn in the Biologia, without discussing the subject, admits that it does not differ in any important respect from Elateridae.

In the classification of LeConte and Horn it is said of the Throscidae that "they do not possess the power of leaping, like most species of the Elateridae, and the fixity of the prothorax on the trunk would show that any such act is mechanically impossible." This has not, however, always been held and it was affirmed by some of the earlier writers to the contrary. A little examination of the pro- and meso-sternum shows the existence of a structure more or less analogous to that of the Elateridae, and close observations of the living insects in the genera *Throscus*

[2]Trans. Am. Ent. Soc., xii, p. 198, (1885).

[1]1916, p. 62.

and *Aulonothroscus* demonstrates their capacity of leaping in a small way, there being in life really considerable mobility of the prothorax at its junction with the posterior part of the body. I have no doubt that the other genera possess the same power, but I have not been able to verify it. It might be observed that the definition of the "family" in the classification is somewhat imperfect, in that it ascribes to the entire group some characters which are found only in one of the two tribes into which it is separated.

Since Dr. Horn's "Synopsis"—1885—collections have greatly increased, so that by the kindness of many correspondents I have been able to examine nearly a thousand specimens. Mr. Rene Oberthür of Rennes, France, the present possessor of the Bonvouloir types, has very obligingly compared a series of specimens sent him by me for the purpose. I am also indebted to M. Edw. Fleutieux for friendly encouragement, and for the loan of material to Mr. Henshaw of the Harvard Museum at Cambridge, Dr. L. O. Howard of the National Museum, Dr. Skinner of the Academy of Natural Sciences, Philadelphia, Messrs. Fall, Van Dyke, Fuchs, Blaisdell, Leng, Roberts, Beutenmüller, Schaeffer, Joutel, Liebeck, Dr. Castle, Chittenden, Dury, Wickham, Bowditch, Richardson and D. B. Young.

The subfamily Throscinae is like most other Elateridae in having a posterior prosternal spine, a mesosternal striking point strongly chitinized, and a fossa receiving the spine, and in having the hind coxae contiguous on the median line. It differs by the very close adaptation of the pro- and mesosternum, as pointed out by LeConte and Horn in the classification, the front and middle coxae deeply immersed, the anterior ones almost hidden by the broad process which is infracoxal as well as intercoxal.

Two very distinct tribes are indicated,—the Lissomini and the Throscini. In the latter and in the genus *Drapetes* of the former tribe, the last ventral segment overlaps the apices of the elytra, engaging the slightly explanate inferior margin which is formed by a continuation of the epipleura, thus more securely locking the elytra. The same adaptation exists in all Eucneminae that I have examined except in *Iorhipis* (*Tharops*). The epipleura in most Elateridae apparently terminating opposite the hind coxae, are in fact turned inward, the inner margin forming

a longitudinal internal carina nearly or quite to the apex, against which rests the acute margin of the abdomen. In the only *Lissomus* I have been able to examine the elytra are free at apex, as in most Elaterinae.

The tribes and genera of Throscinae separate as follows:

Anterior and middle trochanters long; prosternum lobed in front. LISSOMINI

Anterior and middle trochanters short; prosternum truncate in front. THROSCINI

LISSOMINI

Claws toothed at base; metasternum with oblique impressed line; pygidium projecting slightly beyond the elytra..... **Drapetes**

THROSCINI

Antennae fusiform; tarsi simple..... **Pactopus**

Antennae clavate; tarsi with fourth joint bilobed.

Metasternum with long oblique groove for the reception of the middle tarsi..... **Aulonothroscus**

Metasternum with tarsal grooves very short and only feebly diverging from femoral sulcus..... **Throscus**

## LISSOMINI

This tribe is chiefly tropical, only two species of *Drapetes* being in the European catalogues and five in our own fauna. The species, as a rule, are larger with a more or less polished surface and with a more varied coloring than in the Throscini. The mandibles are bifid, the prosternum is strongly lobed, the anterior and middle trochanters are slender and elongate, and the antennae are serrate or even pectinate from the fourth to the tenth joints, and in repose rest not in well defined sulci, but in pockets or enclosed cavities in the anterior part of the flanks of the prothorax, reaching quite to the side margin under the sides of the pronotum, the openings being along the anterior part of the prosternal sutures. The antennae when withdrawn are in the form of a loop, the terminal joints frequently visible in the opening and pointing forward. In one specimen of D. *rubricollis* the pronotum was so translucent that the antennae could be seen beneath at the sides. In *Drapetes* the mesosternum has a striking lobe to engage the prosternal spine, horizontal and much as in ordinary Elaterinae, while in the Melasinae (Eucneminae)

the mesosternum is truncate and without a specially developed striker. The tarsi have joints one to four strongly lobed or lamellate beneath, recalling as has been noted the genus *Galba* in Melasinae.

**DRAPETES** Redtenbacher

Our species have the tarsal claws toothed at base; the metasternum with an impressed oblique line occupying the position of the tarsal grooves in *Pactopus* and *Aulonothroscus:* the prosternum each side with two approximate carinae, a marginal and an inner, reaching from the coxae to the base of the anterior lobe: elytra with a humeral carina which is the basal termination of a submarginal stria, the true elytral margin being below the carina. The carina of the basal angles of the thorax is well marked except in *ecarinatus*, where it is rather obtuse. In *geminatus* and *niger* it is very long. No sexual external characters except size have been noticed in any of our species.

*Table of Species*

Pronotum with long lateral carina....2
Pronotum with short lateral carina....3
2. Prothorax narrower than the elytra, sides sinuate before the base and narrowing in front.
Black, elytra each with ante-median red spot or fascia...1. **geminatus**
Black, immaculate....var. **nitidus**
Prothorax as wide as elytra at base, sides not sinuate; entirely black, elytra with posterior fascia of white hairs, sometimes reaching the apex 2. **niger**
3. Elytra without sutural striae....4
Elytra with fine sutural striae reaching neither base nor apex; surface glabrous or with very minute pubescence....5
4. Black, prothorax red, pubescence more evident....3. **rubricollis**
Black, elytra quadrimaculate with red, pubescence fine and easily removed....4. **quadripustulatus**
5. Black, elytral humeri red....5. **ecarinatus**

1. **Drapetes geminatus** Say

Black, shining, punctate and with rather sparse, suberect pubescence; elytra with a broad, red fascia a little before the middle, which may be continuous and rarely extends upon the epipleura, or be reduced to a spot of greater or less magnitude, or even in var. *nitidus* entirely disappear. Length 3 to 4 mm.

Some specimens show a posterior fascia of white hairs, though less marked than in *niger*. This does not seem to depend upon the state of preservation or the sex, but to be purely individual.

Specimens have been seen with the elytral spots very small, but the type of *nitidus* Melsheimer remains unique; it strongly suggests the next species. Specimens are sometimes seen a little less or a little greater than the measurements given.

It is known from Canada and every state east of the Mississippi except Maine, Rhode Island, Connecticut, Delaware, South Carolina, Wisconsin, Indiana, Alabama, Mississippi and Louisiana, and has been seen or recorded from Iowa, Missouri, Kansas and Texas.

2. **Drapetes niger** Bonvouloir

Elongate, slightly narrower behind, black, shining, the upper surface with two kinds of pubescence, fine dark hairs occupying the disk of the pronotum, where they are suberect, and on the disk and apex of the elytra; more conspicuous white hairs, not closely placed, on the head, anterior and posterior angles of the pronotum, on the humeri, and forming a distinct post-median band on the elytra. Frontal margin of head broadly rounded, slightly reflexed; head moderately, rather sparsely punctate and slightly impressed before the vertex in one specimen, not in the other; antennae inserted under the front, serrate, black except first and second joints which are testaceous. Pronotum rather sparsely punctate, a few of the punctures behind the middle much coarser, about as long as wide at base or perhaps a little less, as wide at base as the elytra, thence gradually, feebly narrowed to the anterior third and then strongly rounded to apex; margin fine, anterior angles much advanced before the middle of the apical margin, lateral carina long, reaching two-thirds the length of the pronotum. Elytra finely, sparsely punctate, gradually narrowing from base and broadly, feebly arcuate to near the tips, thence strongly rounded, punctures finer than those of the pronotum and with a subserial arrangement. Beneath black, finely cinereous pubescent; trochanters, tibiae and tarsi more or less reddish; basal half of prosternum bisulcate, the interval as broad as the sulci, a very few sparse and fine punctures in front, the lobe finely margined at apex and sparsely punctate; sides beneath coarsely, not closely punctate, metasternum more finely, sparsely punctate, abdomen more closely and regularly, finely punctate, the punctures smaller than those of the metasternum. Length 3 mm.

The above rather detailed description is drawn from two specimens found by Mr. Chas. Schaeffer at Brownsville, Texas. It was originally described from Mexico. Rather singularly Dr. Horn, in the Biologia, where it is figured, omits any mention of the lateral carinae of the pronotum.

3. **Drapetes rubricollis** LeConte

Elongate oval, head and underside except the prothorax, black, the latter bright red; elytra deep blue, distinctly, not closely punctate, surface shining, clothed above with suberect stiff hairs, white on the head and elytral apices,

dark or blackish on the thorax and elytra except as mentioned. The apical white hairs are sometimes indistinct. Antennae and palpi piceous, the former serrate. Length 2.5 to 3.25 mm.

Occurs in North Carolina, South Carolina, Georgia, Florida (Biscayne and Key Largo) and Arkansas.

4. **Drapetes quadripustulatus** Bonvouloir

Piceous black, shining, very sparsely pubescent, each elytron with a subhumeral and subapical reddish spot, the latter smaller. Length 2.75 to 4 mm.

"Wisconsin to Florida" according to Horn: Kansas (Snow). Specimens are known to me from Maryland, North Carolina, Florida, Ohio, Missouri, Louisiana, Mississippi and Texas.

5. **Drapetes ecarinatus** Schaeffer[3]

Elongate, subparallel, convex, entirely black except a small humeral area extending upon the epipleura, which is bright red; upper surface glabrous and shining, the head sparsely hairy, and a few whitish hairs along the sides of the thorax, and with underside and legs finely pubescent. Head very sparsely, irregularly punctate, the punctures a little closer at the sides; eyes not prominent, feebly convex, antennae strongly serrate, entirely black, basal joint rather coarsely punctate.

Prothorax a little wider at base than long and as wide as the base of the elytra, sides slightly narrowing from base and feebly sinuate, thence strongly arcuate to anterior angles, which are somewhat more produced than the middle of the upper margin, so that the apex is broadly emarginate and scarcely more than half as wide as the base; convex with the sides tumid so that the fine lateral margin is inferior and hidden from above; punctures fine anteriorly, at middle and sides, becoming coarser behind, sparser and more irregular on the disk and at the middle of the base, closer and more regularly placed towards the sides behind, a marginal series bearing short hairs; a faintly elevated, smooth line at middle of basal third; base broadly lobed and feebly sinuate at middle, strongly obliquely sinuate each side, the hind angles acute, produced behind a little further than the basal lobe. Scutellum equilateral, feebly arcuate in front, more strongly at sides, acute behind. Elytra finely, sparsely, subseriately punctate, punctures becoming finer at base and at the sides anteriorly, convex, nearly twice longer than wide, subparallel, feebly wider behind the humeri and broadly arcuate, apex obtuse. There is a fine subsutural stria reaching neither base nor apex; submarginal striae carinate in front. Prosternum bicarinate each side to base of lobe, finely sulcate each side at basal half, the sulci disappearing before and succeeded by two or three punctures each side; there is also a line of distinct hair-bearing punctures just

[3]Bull. Brooklyn Ent. Soc., 1916, p. 62. [I give herewith Mr. Blanchard's detailed description, replacing the specific name used by him by that under which Mr. Schaeffer has recently described the species. H. C. F.]

within the outer carina; lobe margined in front, sparsely, rather coarsely punctate; flanks coarsely, not closely, variolate punctate, with hairs. Meso-metasternal suture fine but distinct. Mesosternum smooth, impunctate and glabrous narrowly along the middle and along the posterior margin, sparsely, gradually more coarsely punctate at sides, the punctures bearing short hairs; a somewhat sinuous impressed line reaching from middle coxae obliquely two-thirds toward outer hind angle of metasternum. Anterior and middle coxae deeply inserted and narrowly separated by the prominent lateral extension of the mesosternum. Episterna of metasternum very narrow and impunctate in front, a little wider and punctate behind; epimera not visible. Abdomen finely, rather closely punctate and pubescent, punctures a little coarser on last segment; segments one to four equal, fifth longer, with apex strongly arcuate. Legs black, finely, sparsely punctate and pubescent. Length 4.5 to 4.75 mm.

Lower California: Santa Rosa; El Taste.

This species is only equalled in size in our fauna by *Aulonothroscus validus* and *Pactopus hornii*. In the Biologia Dr. Horn says of the very fine antennal stria in certain species that it is sometimes present, at others absent. The few specimens taken by Mr. Beyer all show it, but it is possible examples may occur without it.

## THROSCINI

In this tribe the mandibles are entire and acute at tip, the antennae clavate, or in *Pactopus* fusiform, in repose resting in open grooves extending along the prosternal sutures, thence bent outward across the posterior part of the flanks of the prothorax nearly to the side margin; the prosternum is truncate; the anterior and middle trochanters are short; the anterior femora have a distinct angle, and the middle femora a dentiform angle at base on the upper side, serving to yet more firmly fix the femur when retracted. This structure was called to my attention by M. Fleutieux, to whom it was communicated by M. Louis Bedel. The mesosternum at middle before the fossa is produced in a prominent vertical lamina (recalling the structure seen in *Philhydrus*), against the compressed and excavated sides of which rest the anterior coxae, while the free angle forms the striking point for the prosternal spine, which when released slips along the lower surface into the meso-fossa as in Elateridae.

### **PACTOPUS** Latreille

Besides the characters in the table and in the description below, it should be mentioned that the middle and posterior

tarsi are received in narrow oblique grooves upon the metasternum and the first three segments of the abdomen respectively. The first segment of the abdomen each side of the middle, is obliquely crossed by a distinctly elevated line, which limits the inner margin of the shallow excavation which receives the end of the tibia in repose.

**Pactopus horni** LeConte

Very elongate, dull or feebly shining, finely and closely punctulate above and below, clothed with fine prostrate hair, no coarser hairs intermixed. Head convex, punctate, eyes orbicular, moderate, feebly nicked by the encroaching of the feeble supra-antennal ridges, orbits impressed. Antennal fossae open, the clypeus wider in front; antennae fusiform, first joint scarcely longer than the next two, second a little shorter, third and following about as wide as long, gradually increasing in size, last joint longer, subacute at tip, received in cavities or grooves extending along the prosternal sutures, thence abruptly outward to hind angles.

Prothorax a little less than twice as wide at base as long, hind angles strongly produced behind, embracing the base of the elytra, the sides margined to the middle or beyond from the base, strongly arcuate and cariniform in the males at base, thence deeply sinuate and narrowed to apex, which is but little more than one-half as wide as the base. In the female the prothorax is less arcuate at the sides of base because only feebly sinuate and more obliquely narrowed to apex, base broadly and deeply sinuate each side and broadly lobed at middle, disk convex, flattened across the base, rather coarsely and closely punctate; scutellum narrow, elongate. Elytra elongate, depressed at base, somewhat obliquely impressed behind the humeri, especially in the males, gradually narrowed behind, more arcuately in the female; striae fine but well marked, closely set with punctures which, on the disk, are a little wider than the striae; the striae entire, reaching from base to apex except that on the humeri; they are somewhat obsolete or interrupted, and the second and third are shorter at apex, ninth extending around the apical border to the sutural, intervals flat, impunctate; inferior margin received by the projecting and overlapping last ventral.

Prosternum rather narrow, sparsely punctate and pubescent, striae entire or nearly so, divergent in front, on both sides of antennal grooves coarsely and closely punctate; metasternum anteriorly and at sides rather coarsely punctate, more finely at middle behind, a short, fine, median, smooth line more or less evident. Abdomen more coarsely punctate at sides especially anteriorly, more finely and sparsely at middle and on last segment. Anterior tibiae sinuate and narrowed at apex on outer side; tarsi with first joint equal to second and third, last joint long. Length 3 to 5 mm.

There is but one species known; it is, like many others of the family, very variable in size. As has already been indicated in Henshaw's Third Supplement to the "List" *P. fuchsi* Casey is

not different, it being by the description evidently based upon females of this species.

Northern California; Nevada; Oregon; Washington; Vancouver, British Columbia. I have seen about fifty specimens in all.

### AULONOTHROSCUS Horn

The character in the table of genera is about the only one observed. The side margin of the thorax is as a rule longer than is usually the case in our species of *Throscus*. Most of the species are more robust and more coarsely sculptured than in *Throscus*, and many have the antennal club of the male pectinate and that of the female feebly pectinate. A smaller number—viz.—*punctatus, validus, laticeps* and *calocerus*, have the metasternum with a very fine, long and soft pubescence, which is easily obscured by careless mounting.

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[*Aulonothroscus rugosiceps* Schaeffer[4] was unknown to Mr. Blanchard and I have not thought best to modify his table to insert it. It is said by Mr. Schaeffer to be related by its entire eyes and long, entire prosternal striae to *constrictor*, from which it differs in the distinctly carinate hind angles of the prothorax, the carinate head, and the absence of the basal impressions of the prothorax, which are very pronounced in *constrictor*. Length 4 mm. Brownsville, Texas. H. C. F.]

1. **Aulonothroscus parallelus** new species

Very elongate and parallel, thorax impressed each side at base, but less strongly than in *teretrius*, the dorsum less arched longitudinally than in that species. Head and thorax uniformly, finely punctate, thorax as wide as the elytra, one and one-half times as wide as long, sides rather parallel at base, thence arcuate to apex. Elytra with rather fine striae, with subelongate punctures but little larger than those of the intervals, these rather finer than the thoracic ones and with the usual arrangement, although rather more distant than in the next species. Prosternum with striae more strongly divergent, reaching the anterior third or fourth, somewhat convex and punctate more closely in front, more broadly convex in front, punctures of flanks, sides of metasternum and abdomen similar and much as in the next. Length 3.5 to 3.7 mm.

One more slender specimen has the antennal club a little broader and is, I presume, a male. There is no trace of long hairs on the metasternum. This is the most elongate species seen and could only be confused with the following, which it closely resembles in punctuation, although punctures are rather finer and sparser. The much more elongate form, less arched dorsum and less impressed base of thorax will distinguish it. The prosternum also is broader and more convex anteriorly, and the striae more divergent.

Virginia—one specimen (Mr. Liebeck); three in the Zimmerman Collection at Cambridge, without locality but undoubtedly southern.

[4]Bull. Brookl. Ent. Soc., 1916, p. 63.

2. **Aulonothroscus teretrius** new species

Elongate, parallel, convex, piceous brown, the prothorax deeply bi-impressed at base; pubescence very fine, the coarser hairs short. Head and thorax uniformly punctate, the latter more coarsely and closely. Thorax as wide as the elytra, about one and one-half times as wide at base as long, sides arcuate from base to apex, a little more obliquely in the male. Elytra parallel, slightly obliquely impressed behind the humeri, striate with moderately close, subelongate punctures larger than those of the intervals, the latter a little finer than those of the pronotum and with about the usual arrangement, two to five with irregular double punctuation at base, which becomes single behind the middle, the outer intervals and the sutural with single series. Prosternum sparsely punctate, a little more closely anteriorly, striae gradually a little divergent anteriorly, reaching the anterior third or fourth; punctures of the flanks of the prothorax and those of the abdomen about alike in size, a few coarser ones at the sides of the metasternum, becoming smaller and sparser at middle; mesosternal suture not evident. Length 2.9 to 3.5 mm.

The male has the club wider and pubescent, the female also has the club joints slightly produced laterally. The larger specimens at first sight might be confounded with *parallelus*, but they are evidently more robust and the prosternal striae are less divergent. The male antennal club is broader than in that species. One male has remains of long pubescence on the metasternum, but the others are in too poor condition to show it.

I have seen three males, Detroit (Hubbard and Schwarz—Nat. Mus. Coll.); one male, two females, Black Mountains, North Carolina (Van Dyke and Beutenmüller) and three females without locality in the Cambridge Museum originally from Zimmerman. Type in Nat. Museum Collection. Type No. 7766.

3. **Aulonothroscus schwarzi** new species

Elongate and parallel like *teretrius*, finely, thinly pubescent, the coarser hairs fine and not conspicuous, sparsely punctate. Head moderate, convex, not closely punctate; eyes small, alike in the sexes, minutely nicked at the insertion of the antennae. Antennae with joints laterally produced in both sexes, much more so in the male. Thorax convex and strongly bi-impressed at base, scarcely more dilated at sides behind in the male, in both sexes sides parallel at base, thence strongly arcuate to anterior angles, uniformly, not closely punctate, a subobsolete carina visible at hind angles in some specimens. Elytra elongate parallel, finely striate, first and second a little more finely, with moderately close, rounded punctures, not at all elongate, finer in the sutural and subsutural striae; intervals not closely punctate, on two to five almost regularly biseriately so towards the base, becoming uniseriate behind; sutural and six to seven uniseriate, eight to nine biseriate, the latter finer but distinct. In one small male the punctures are almost entirely uniseriate. Prosternum sparsely punctate, punctures larger and more numerous ante-

riorly, feebly convex, striae diverging in front and reaching anterior third; sides, and sides of metasternum and abdomen variolate punctate, femora sparsely variolate punctate. Length 2.5 to 3.5 mm.

May be known by the parallel form, divergent prosternal striae, and strictly punctiform impressions of striae. In the small male the general punctuation is fine and is less obviously variolate beneath.

Florida—four collected by Hubbard and Schwarz (National and Cambridge Museums); Texas—one much larger female in collection of F. C. Bowditch. Type No. 7767 National Museum Collection.

4. **Aulonothroscus punctatus** Bonvouloir

Dark brown, form oblong, not narrowed behind, pubescence fine. Head convex, rather sparsely punctate, the male with eyes moderate, not obviously larger than in the female. Antennae with the joints of the male club more produced than in the female, inner side nearly as long as the distal, which is slightly concave; tenth joint narrowed outwardly, nearly twice as long as broad, distal side concave; eleventh joint rather broad, distal side oblique, outer and proximal sides broadly arcuate, widest beyond the middle. Thorax clothed with erect pubescence, at base wider than the elytra, apex about one-half as wide as base, sides at base parallel or even convergent behind, thence slightly arcuate and obliquely narrowed to anterior angles, margin reaching anterior fourth, surface convex, slightly flattened at angles and strongly bi-impressed at base, moderately regularly, not very closely punctate, the punctures fewer and finer at hind angles. Elytra elongate, obliquely impressed behind the humeri, arcuate from posterior third to apex, striae fine, not much impressed, with close subelongate punctures, intervals two, three and five irregularly and not closely punctate to middle, sutural and outer with uniseriate punctures, those of sutural two very fine and indistinct. Prosternum feebly convex, sparsely punctate, a little more coarsely in front, striae reaching anterior third, sides sparsely variolate punctate; sides of metasternum a little more strongly and closely, the abdomen sparsely and more finely punctate. Metasternum largely covered with fine, soft, erect pubescence. Length 2.9 to 3.9 mm.

The female may be much larger than the male; it is then more coarsely punctate on the thorax and with elytral striae stronger. The sides of thorax are not dilated at base and are broadly rounded to apex, the hind angles with short obtuse carina more or less distinct; margin reaching anterior fourth. Smaller specimens occur with the thorax more finely punctate, and similarly the males vary in size and punctuation.

Bonvouloir's description applies well enough to the female,

which Dr. Horn, however, described as *invisus*. The latter author very evidently referred the females of *constrictor* to *punctatus*, a specimen so labelled having been sent me by Dr. Skinner from the Horn collection. Dr. Horn also so named specimens which I sent him on two or three different occasions. It would appear that neither author had seen the male.

Specimens have been seen from Massachusetts, New York, Pennsylvania, New Jersey, Maryland, Virginia, Ohio, Michigan and Iowa.

5. **Aulonothroscus validus** LeConte

Elongate, robust, punctuation fine. Head clothed with very fine pubescence, the longer hairs fine, the very finely, densely punctate surface plainly visible through the pubescence. Head convex, finely, sparsely punctate; eyes small, alike in the sexes, with a minute emargination, orbits narrowly impressed. Antennal club with joints slightly produced laterally in the female and scarcely more so in the male, the pubescence not conspicuous. Prothorax convex, sides at hind angles a little more dilated and explanate and more oblique to the anterior angles in the male, rather strongly arcuate in the female, distinctly, broadly bi-impressed at base, side margin fine, reaching from base to anterior third or fourth, hind angles not evidently carinate, surface extremely minutely, rather closely punctulate and with rather sparse variolate punctures, finer anteriorly and at the sides, coarser at the middle and base. Elytra elongate subparallel, broadly and obliquely impressed behind the humeri, surface minutely punctulate, striae very fine with rather distant, minute punctures, coarser toward the base, intervals rather sparsely, irregularly, variolate punctate (the sutural with a single series of minute punctures) becoming somewhat uniseriate behind, coarser and confused at apex. Last dorsal feebly projecting at apex. Prosternum coarsely variolate punctate in front, more finely and much more sparsely behind, striae reaching from base to middle or a little beyond; sides rather coarsely and sparsely variolate punctate. Metasternum very finely and sparsely punctate at middle, the punctures a little larger anteriorly, more coarse, dense, and variolate at sides. Abdomen sparsely variolate punctate along the middle, more closely and coarsely at sides, and especially on the last ventral. Length 2.5 to 5 mm.

The male has the long soft pubescence of the metasternum seen in several other species, but rather less developed in area apparently. The females seem to far outnumber the males in collections. The lateral carinae of the clypeus are usually quite distinct, limiting the antennal fossa, but they are also sometimes feebly evident in *punctatus, constrictor, calocerus* and *laticeps*.

Northern counties of California to Lake Tahoe, also in Santa Clara County; Nevada; Oregon; Washington; Vancouver, British Columbia.

6. **Aulonothroscus laticeps** new species

Elongate, feebly narrowed behind, pale reddish brown above and below, the head above and the thorax except the hind angles, darker. Pubescence very fine, the usual coarser hairs rather short and fine. Head large, finely punctate, flattened and exactly vertical between the eyes when retracted, the latter, in the male, large, separated by little more than a diameter, orbits distinctly though finely impressed on the inner side, a small but distinct emargination at the insertion of the antennae. Prothorax nearly twice as wide at base as long, as wide at base as the elytra, and at apex about two-thirds as wide; disk convex, strongly bi-impressed at base, the hind angles broadly explanate, with a short very fine but distinct carina near the margin; sides at base parallel, then strongly arcuate to a little before the middle where the margin ceases, thence slightly obliquely narrowed to the anterior angles, forming a marked sinuation before the middle; surface rather finely and closely, uniformly punctate, more finely and sparsely towards the hind angles, narrowly impunctate inside the carina. Elytra elongate, slightly obliquely impressed and constricted behind the humeri, thence broadly arcuate and feebly narrowed to near the apex, where they are strongly arcuate to tips, finely striate, with small, subelongate, rather close punctures a little larger than those of the intervals, which are rather fine, irregular at basal half of the elytra on the second to fifth intervals, in single series beyond the middle and on the sutural and outer intervals. Prosternum flat, punctate, striae parallel and nearly entire, flanks and also the metasternum and abdomen rather finely, not very closely punctate. Metasternum in the male with a long, soft, erect pubescence. Length 3 mm.

The only specimen seen is a male (Nat. Mus. Collection; Type No. 7768), collected by Hubbard and Schwarz at Detroit, Michigan. The antennae are hidden, but will no doubt resemble those of *calocerus*. It is nearest to *calocerus* but is distinct from the male of that species by the yet larger eyes, the more explanate hind angles of the prothorax and the less close punctuation of the elytral intervals. *Calocerus* also is entirely piceous brown, but darker specimens of *laticeps* may occur. The sinuation of the sides of the prothorax recalls the form seen in *Pactopus* male, though less strong, the thorax being shorter and wider at apex.

7. **Aulonothroscus calocerus** Bonvouloir

Very similar in form to *constrictor* but larger and with a shorter thorax; pubescence coarse and conspicuous. Head large, finely, moderately punctate, the pronotum rather uniformly and a little more coarsely so. Eyes with a very small emargination at the insertion of the antennae; larger in the male; front convex. Antennae in the male with club strongly pectinate and with erect pubescence; first joint stouter and twice as long as the second, the latter short and thick, as long as wide and equal to the third and fourth, third to eighth very small and close, slightly transverse; the sixth, seventh and eighth

feebly serrate; ninth triangular, outer angle strongly and narrowly produced, the anterior or apical side next to the tenth joint being deeply sinuate or emarginate; tenth joint with the inner side or axial length equal to the same side of the ninth, slightly sinuate, obliquely produced laterally, the anterior side deeply sinuate; eleventh joint strongly laterally produced, narrowly acute at point of attachment to tenth, gradually wider externally, the proximal side at first nearly straight then broadly arcuate to the somewhat acute apex, distal side straight, widest a little beyond the middle and about three times as long as wide. The sinuation of the distal sides of the ninth and tenth joints is deep and the proximal sides of joints ten and eleven are broadly arcuate, so that when the joints are closely applied there are large openings between. Antennae of female not seen. Thorax transverse, a little more than one and one-half times as wide at base as long; in the male wider than the base of the elytra with hind angles explanate and punctate, parallel at sides, thence arcuate and feebly sinuate and oblique to anterior angles, wider in front in the male than in the female. In the female the sides of the thorax are rather broadly arcuate from base to apex, a feeble sinuosity behind the middle, hind angles not explanate; carinae not evident in either sex, strongly bi-impressed at base; punctuation of pronotum rather coarser in female. Elytra slightly, obliquely impressed behind the humeri, sides a little rounded, scarcely narrowed, obtuse at apex, in male a little less rounded and apex less obtuse; striae stronger in the female, with rather close, subelongate punctures larger than those of the intervals which are rather small and close, irregularly double or even triple on the second, third and fifth intervals, the irregular punctuation reaching farther than usual posteriorly; sutural and outer intervals uniseriately punctate. Last abdominal segment not projecting beyond the elytra. Prosternum flat in male, rather sparsely and finely punctate, striae nearly entire, sides of body moderately punctate, the metasternum at middle very sparsely and finely so, the metasternum largely covered with long, soft pubescence. In the female the prosternum is somewhat convex and more coarsely punctate, sides of prothorax and metasternum more coarsely and the abdomen also more closely punctate. Length 3 mm.

One pair of nearly equal size from Fredericksburg, Virginia (W. D. Richardson).

The male may be easily distinguished by the characters given; the female looks much like a large female *constrictor* or a smaller female *punctatus*, from the former (of which I have seen none quite so large) it may be known by the elytra less constricted and not narrowed behind and more obtuse at apex, and the more numerous punctures of the intervals and the coarser and closer punctuation of the abdomen. The larger females of *punctatus* will be easily recognized, but owing to the variability of the punctuation in this species I am led to fear some difficulty in always placing the female of *calocerus*, if the specimen above described is the true female. It might be mentioned that this female was

selected from a series of about three dozen specimens of *constrictor* from the same locality, two of them bearing the same date—June 7, 1900, the rest, May 14 to 30 of the same year; the male, May 19, 1891. The prosternal striae are rather more abbreviated in the male, and as much so as in many *punctatus*. A second female from "N. Y." (Chas. Fuchs Coll.) I am inclined to place here also; in it the prosternal striae are longer as in the male, the punctuation triple on the third interval and double on the first to the middle. In the Virginia examples the punctures are double only a very short distance at the base of the first interval.

Bonvouloir described and figured this species, giving also a fairly characteristic figure of the antennae in the short paper which appeared shortly after his monograph. As may be inferred it is very different—especially in the male—from *constrictor*, of which it was made a synonym by Dr. Horn, who probably had not seen a specimen.

8. **Aulonothroscus constrictor** Say

Oblong, robust, narrowed behind, brownish piceous or with the elytra rufopiceous in the male; rather coarsely hairy, integuments shining. Head convex, finely, not closely punctate, clypeus with side margin limiting antennal foveae more or less evident; eyes small, scarcely larger in the male, feebly nicked at insertion of antennae. Antennae with club very similar in the sexes, slightly asymmetric, the tenth joint transverse, the last joint smaller in the female. Thorax convex, strongly bi-impressed at base, sides arcuate in the female; slightly dilated at base, parallel and then oblique in the male; margin two-thirds to three-quarters of the length, carina of hind angles feeble or wanting, rather coarsely and uniformly punctate in the female, more finely in the male. Elytra twice as long as wide, distinctly narrowed behind, obliquely impressed behind the humeri, more strongly in the male, striae well defined, with closely placed elongate punctures, not coarser at apex, intervals with the usual irregular punctuation reaching on the disk to or behind the middle, thence uniseriate; in the female sometimes irregular and double to the tip on the fifth interval, the punctures nearly as large as those of the pronotum; outer intervals more finely and sparsely punctate, six to eight mostly uniseriate except at immediate base, the ninth interval in the female showing a double series of fine punctures its whole length, these being so fine in the male as to be observed with difficulty. Prosternum rather wide, sparsely punctate, striae usually nearly entire, sometimes, especially in the female, shorter, but the margin itself reaching very nearly to the apex. Flanks of prothorax and sides of metasternum and abdomen rather coarsely and closely punctate, metasternum at middle much more finely and sparsely so. Length 2 to 3.3 mm.

The shorter measurement applies to an exceptionally small male. This species appears to be the most common one from the Mississippi Valley to the Atlantic. The name was given by Say to "our insect" without any adequate description, he apparently having known but one species. In his Monograph, Bonvouloir described and figured the male under this name, but in a supplementary publication he described the female received from Dr. Schaum as a type of Say's species, and substituted the name *alienus* for the previously described male, which he says is very near but is really distinct.

The simple antennal club, little different in the sexes, the long prosternal striae and almost entire margin, and the form narrowed behind must be relied upon for the separation of this species.

New Hampshire, Vermont, Massachusetts, New York, Pennsylvania, New Jersey, District of Columbia, Virginia, Michigan, Wisconsin, Minnesota, Illinois, Ohio, North Carolina, Georgia, Florida and Arkansas. One specimen labeled "Or." I think is open to doubt.

[*A. rugosiceps* Schaeffer probably comes in here. See remarks following table of species. H. C. F.]

9. **Aulonothroscus detritus** new species

Very small, pale reddish brown, shining, slightly narrowed behind, clothed with fine and coarse hair. Head convex, finely punctate; eyes small, entire and widely distant, orbits very finely impressed, intra-antennal ridges feeble. Thorax not very convex, feebly bi-impressed at base, nearly one-half wider than long, in front as wide as long, sides broadly arcuate, margin fine, scarcely more than one-half, obtusely carinate at hind angles, disk very finely, sparsely punctured, the punctures larger toward the sides and very much larger toward the hind angles; base at middle feebly lobed, broadly sinuate each side, hind angles prolonged. Scutellum as usual small, truncate in front, arcuate each side, as broad as long. Elytra not much more than twice as long as wide, feebly, obliquely impressed behind the humeri, sides broadly arcuate and slightly narrowed behind, rather obtuse at tip; striae extremely fine, with distant, minute punctures becoming more evident at tip; intervals with very fine, sparse, mostly uniseriate punctures. Prosternum narrow, striae parallel, abbreviated by about one-fourth, a few minute punctures anteriorly, punctures coarser on flanks of prothorax and sides of metasternum, a short transverse row on first ventral at sides; middle of metasternum minutely, sparsely punctate, a little more coarsely in front. Abdomen finely, sparsely, variolate punctate, a little more coarsely on last ventral. Length 1.8 mm.

The hind angles of the prothorax are not at all dilated and I think the one specimen is probably a female. The antennal

club is small with long irregular hairs. The tenth joint is transverse and it is likely that the male will have a much broader club. In size and in the minute punctuation this resembles *Throscus parvulus*. If this be a female, the male is liable to be very minute indeed.

Brownsville, Texas (Wickham).

10. **Aulonothroscus distans** new species

Elongate, narrowed behind, piceous brown with the usual finer and coarser pubescence, closely and minutely punctulate above and below and with coarse, sparser punctures. Head bicarinate, the carinae somewhat variable in prominence, widely separated on the occiput, thence narrowing to about one-half at the clypeus, on which they feebly diverge; surface finely and sparsely punctate; eyes moderate, alike in both sexes, with a small, but distinct, rounded emargination, and bounded on the inner side by a deep groove from the emargination to the upper margin. Antennae with the club feebly pectinate, contractile and pubescent in the female, much more strongly so in the male and clothed with conspicuous erect pubescence. Thorax nearly twice as wide at base as long in the male, and as wide as or a little wider than the base of the elytra, sides parallel at base, thence obliquely narrowed to the apex, which is about equal in width to the length at the middle. In the female the thorax is a little narrower and more arcuate from base to apex, side margin reaching the anterior fourth, carina of hind angles short and fine, about one-fourth the length of the margin, surface rather convex, a small impression at base each side of the scutellum, thence to the carina the base is somewhat flattened. Elytral punctures rather fine and uniform, about two diameters apart; striae well defined, with moderately closely placed, rounded punctures, which as well as those of the intervals are about the same as the thoracic ones; sutural interval with a single series of punctures; second, third and fourth irregularly double at base, becoming single posteriorly; outer intervals with single series, the marginal stria much deeper and wider. Beneath minutely punctulate and pubescent; prosternal striae parallel, feebly divergent anteriorly, interval smooth, finely, very sparsely punctulate at base, less finely and sparsely at apex; flanks rather coarsely variolate punctate; metasternum and abdomen rather finely, not closely punctate. Length 2.6 to 3 mm.

The punctuation is variable, being much finer and sparser in some examples. The extreme measurements are both from females.

Marion, Massachusetts (1 ♀, Bowditch); Central New York (D. B. Young), (Dr. Blaisdell, 1 ♀); Black Mountains, North Carolina (2 ♂, 1 ♀, Beutenmüller).

11. **Aulonothroscus pugnax** Horn

[Mr. Blanchard's manuscript contains no description of this species, of which he had seen no specimens. The original de-

scription was based on a single male from Florida. In Insect Life (III, p. 41), Mr. Schwarz records the finding of a specimen in the District of Columbia. This specimen was afterward lost in sending it to Dr. Horn. H. C. F.]

12. **Aulonothroscus convergens** Horn

Elongate, narrowed behind, piceous or reddish brown, clothed with fine pubescence and conspicuous longer hairs, surface shining, the minute punctuation microscopic. Head convex, finely, sparsely punctate with two, not distant, converging carinae which meet on the clypeus, thence strongly divergent to the lower or anterior angles of the clypeus. Eyes deeply, triangularly emarginate at the insertion of the antennae, orbits finely impressed, separated in the female by a distance greater than their own diameter and in the male by a little less than a diameter. Antennae with the club smaller in the female, but with joints distinctly produced laterally; in the male larger with joints more prolonged laterally. Thorax not very convex, one-half wider than long, apex about as wide as the length, sides finely margined nearly to apex, a fine distinct carina within, more than half as long as the margin, feebly bi-impressed at base, finely, uniformly, not closely punctate, sides broadly arcuate in female, in male more dilated at base with sides parallel, then obliquely narrowed anteriorly. Elytra as wide at base as thorax, gradually, distinctly narrowed behind, more strongly in the male, broadly obliquely impressed at sides behind the humeri, striae very fine with rather distant, small punctures not larger than those of the intervals, which are smaller than those of the pronotum, sparse and a little irregular near the base but mostly uniseriate and finer, those of the striae much coarser at apex. Prosternum narrow with striae parallel and entire, a few small punctures anteriorly, flanks and sides of metasternum rather strongly and coarsely cribrate, middle of metasternum and hind coxae more finely punctate. First ventral with coarse punctures at sides, the other segments sparsely punctate, the last more coarsely. Length 1.7 to 2.5 mm.

Like *distans* this species is very similar in form to *Throscus chevrolati*, and more especially to the large form named *carinicollis* by Schaeffer. From *distans* it is easily distinguished by the much more deeply emarginate eyes differing in the sexes, and much more approximate carinae. The carinae are variable in prominence, being sometimes quite feeble. *Pugnax*, with similar eyes, has the carinae parallel, not meeting at the front margin.

Specimens are before me from New York, District of Columbia, Tennessee, North Carolina, Georgia, Florida and Louisiana.

13. **Aulonothroscus nodifrons** new species

Form of *convergens* female or a little stouter, narrowed behind, brownish piceous, finely pubescent, the longer hairs of the elytral striae distinct; elytral striae nearly obsolete except the sutural, which is fine, and the deep ninth or marginal. Head rather coarsely punctate, less closely on the occiput, convex, the epistoma anteriorly abruptly inflexed, deeply impressed and strongly,

broadly emarginate, the emargination apparently with a fine membranous border, the clypeus filling the emargination, hence nearly as long as wide, the anterior outline strongly, narrowly arcuate at middle, somewhat oblique each side, broadly arcuate behind, and bearing a small, distinct, smooth, subacute tubercle at middle. Front bicarinate, the carinae distant on the vertex nearly the width of the eyes, at first parallel, then slightly divergent an equal distance and uniting with the well-marked transverse margin of the front above the antennae, which reaches the emargination of the eye. Eyes moderate in size, broadly and deeply triangularly emarginate two-thirds the width of the eyes, the inner lobe much narrower than the outer; orbits impressed on the inner side. Antennae with first joint short, stout, the second shorter and not quite so thick, third to eighth as usual; club small, scarcely longer than the preceding six joints, finely irregularly pubescent; ninth joint as broad at apex as long, tenth transverse, one-half wider than long, eleventh triangular, axial side longest. Prothorax transverse, narrowed in front, sides arcuate and distinctly margined very nearly to the anterior angles; a well-defined carina from the hind angles to middle, parallel with and near to the margin; base of usual form, feebly bi-impressed at middle, surface shining, sparsely, rather coarsely punctate on the disk, more closely at the sides, a sparse, very fine punctuation interspersed. Elytral striae except sutural and marginal very difficult to trace, being represented by fine, rather distant punctures not differing from the sparse punctures of the intervals, but becoming stronger at apex; humeri briefly, obtusely tricarinate due to the impressions of the seventh and eighth striae. Beneath, prothoracic flanks coarsely, not densely punctate; prosternum at middle with margins defined to apex, becoming much wider behind; sulci entire, parallel, the interval from front to rear, gradually more strongly, narrowly convex or subcarinate; a few distant punctures anteriorly, more finely and very sparsely punctate behind, the deeply concave sides punctate. Metasternum and abdomen moderately, coarsely, not closely punctate; tarsal grooves somewhat arcuate. Length 3 mm.

A single female specimen collected at Brownsville, Texas, by Mr. Chas. Schaeffer and belonging to the Museum of the Brooklyn Institute.

Distinct from other species of the *convergens* group in our fauna by the effaced elytral striae, the form of the clypeus and labrum, the still more deeply emarginate eyes, and other characters. Dr. Horn describes *Aulonothroscus fraternus* (2 mm.) from Mexico, in the Biologia, as having the elytral striae indicated by fine punctures, prosternal striae entire and eyes entire. In our fauna those species having entire eyes have the prosternal striae abbreviated, while the species with entire prosternal striae have the eyes distinctly more or less emarginate. The male of the present species will undoubtedly have the antennae larger; its discovery will be awaited with much interest.

**THROSCUS** Latreille

The species of this genus in our fauna are as a rule much less robust than the species of *Aulonothroscus*, more finely sculptured and paler in color. The antennae exhibit little variation. In *carinicollis* the club is a little broader and more hairy in the male, and the eyes are larger in the same sex. Our species with divided eyes and entire prosternal striae, have in the male the elytral margin with a rather conspicuous spreading fringe of pale hairs, some vestiges of which almost always remain in the most poorly preserved specimens. This character was first observed in certain European species about the time of Dr. Horn's paper.

In the European fauna all the members of the tribe Throscini belong to this genus. In the Wiener Entomologische Zeitung (VIII, p. 35), Reitter gives a synoptic table of eleven species.

Our species may be separated as follows:

1. Eyes entire; head not carinate; prosternal striae entire.....1. **horni**
   Eyes deeply divided; head bicarinate.....2
2. Prosternal striae entire; elytra of ♂ with fringe of long hairs.....3
   Prosternal striae abbreviated; elytra ♂ not fringed.....6
3. Pubescence long.....4
   Pubescence short and closely appressed.....5
4. Eyes larger, especially in the ♂, orbits impressed; cephalic carinae stronger and rather more parallel.....2. **carinicollis**
   Eyes smaller, alike in the sexes; size smaller and form narrower. 3. **chevrolati**
5. Form broader, less narrowed behind, interstrial punctures becoming variolate posteriorly.....4. **mendax**
6. Pubescence very short and close.....5. **sericeus**

1. **Throscus horni** nom. nov.

[This name is proposed by Blanchard for the *alienus* of Horn's Synopsis, which was not the true *alienus* of Bonvouloir, the latter being really the male of *constrictor* Say. The species was quite unknown to Blanchard and he attempts no description. The species, according to Horn, "occurs in the Gulf States." H. C. F.]

2. **Throscus carinicollis** Schaeffer[5]

Elongate oval, narrowed behind, dark or reddish brown with a fine, close pubescence and coarser hairs intermixed. Head convex, finely, not closely punctate, rather strongly bicarinate, the carinae parallel or nearly so in the male, feebly divergent above in the female. Antennae in the male with club broader, somewhat contractile and equal in length to joints one to eight, in the female smaller and only equal in length to joints three to eight. Eyes larger in

[5]Bull. Brooklyn Ent. Soc., 1916, p. 63.

male, separated by a little more than a diameter, impressions rather deep and well-marked, orbits impressed. Prothorax broad, hind angles prolonged, embracing the base of the elytra, in the male frequently broader than the latter, in the female of about the same width; feebly convex with two small impressions at middle of base, side margins reaching anterior third or a little more; hind angles finely carinate, more evidently in the male, sides parallel at base in male, thence briefly arcuate and very feebly sinuate and obliquely narrowed to apex, the latter one-half as broad as base. In the female the sides are rather broadly arcuate from base to apex, finely punctate, the punctures separated by two or three diameters, a little coarser and sparser on the disk behind the middle, finer and still sparser at base, finer toward the hind angles. Elytra twice as wide as long, rather strongly narrowed behind in male, less so in female; very feebly impressed behind the humeri, less so in female; finely, evenly striate with rather close set, elongate punctures, not larger at apex; intervals two to five irregularly, finely punctate at basal half, becoming uniseriate behind; sutural interval irregularly punctate at base in larger specimens, six to eight uniseriately punctate, ninth scarcely evidently punctate.

Prosternum with entire striae, slightly divergent in front, finely, very sparsely punctate, the punctures closer anteriorly; flanks of prothorax coarsely and closely punctate; meso-metasternal suture fine, metasternum nearly impunctate at middle, punctures coarser and closer anteriorly and at sides; hind coxae finely punctate; first ventral with coarser punctures, other segments rather finely, not closely punctate, more closely on last ventral, which is subangulate at apex. Length 2.3 to 3 mm.

I have separated this from *chevrolati* because of its generally larger size, broader thorax, and more narrowed elytra, especially in the male. The eyes seem distinctly larger than in *chevrolati*, and are larger in the male than in the female; the cephalic costae are stronger and more parallel, the antennal club larger and differing more in the sexes. The male has the elytra conspicuously fringed with long hairs. In general the species seems to have a more northern range than *chevrolati*, although examples which I refer here are before me from the Gulf States. The largest specimens are from Idaho.

It is known to me from New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, Maryland, Alabama, Arkansas, Iowa, Lake Superior, Montana, Idaho, Washington (Spokane Falls) and British Columbia (Caribou).

[I have given above Mr. Blanchard's description and remarks in full concerning this species, but have substituted, for the specific name given by him, that under which Mr. Schaeffer has recently described it. H. C. F.]

3. **Throscus chevrolati** Bonvouloir

Elongate oval, narrowed behind, reddish brown to dark brown, the head frequently paler in color, pubescent with fine and coarse hair. Head with fine, sometimes almost obsolete, distant carinae, slightly divergent above and also on the clypeus below; very finely, not closely punctate. Eyes small, with dividing impression deep, not evidently differing in the sexes. Antennae not greatly differing in the sexes, club with short, even pubescence in the male, more irregularly pubescent in the female, about as long as joints two to eight, ninth joint not longer than wide, tenth broader transversely than long, eleventh somewhat acuminate at apex and about as broad as long, sometimes a little longer than wide. Prothorax two-thirds wider than long, sides more parallel at base in the male, thence obliquely narrowed to apex, margin usually short, but variable; surface finely, regularly punctate, with a fine carina at hind angles more or less evident. Elytra finely striate, striae not closely punctate, intervals with the usual punctures, sides less obliquely and more arcuately narrowed behind than in *carinicollis*. Prosternum with striae entire, divergent in front; finely, sparsely punctate anteriorly; sides of prothorax beneath, metasternum and abdomen punctured nearly as in the preceding species but more finely; punctures at sides of first ventral scarcely coarser. Length 1.75 to 2.75 mm.

After several attempts to satisfactorily separate *parvulus* and *sejunctus*, I am obliged to unite both with the present species. The uniseriate punctures of the elytral intervals, said to be characteristic of the forms above named, do not seem to hold good, the arrangement of the punctures being practically alike in all, but punctures and striae are much finer in western specimens than is usually seen in eastern ones; yet I have seen a very few small specimens from the East (Illinois—Mr. Leng; Michigan and Florida—Nat. Mus. Coll.) that cannot be distinguished from typical *parvulus* from Texas, Vermont, Arizona, and California.

The relatively coarser punctuation of the prothorax and anterior prosternum ascribed to *sejunctus*, seems merely characteristic of larger specimens, usually females.

[Horn says of this species—"widely distributed from the New England States to Louisiana and Iowa." Mr. Blanchard fails to record in his manuscript any of the numerous eastern localities for this species, naming only those that follow, which obviously apply to the western forms *parvulus* and *sejunctus*. H. C. F.]

California (Fresno, Los Angeles); Arizona (Ft. Yuma, Pinal Mountains, Chiricahua Mountains); Utah (Utah Lake, Provo); Oklahoma (Atoka); Texas (Brownsville, El Paso); Michigan (Detroit, a small ♂—Nat. Mus. Coll.) and North Illinois (a small ♀—Leng Coll.).

4. **Throscus mendax** Horn

Oblong, feebly or not at all narrowed behind, rather shining, finely pubescent, the coarser hairs sometimes present but not conspicuous; reddish or darker brown, the elytra frequently darker than the head and thorax. Head finely, closely punctulate with not very evident, sparse, slightly coarser punctures, bicarinate, the carinae distant and slightly convergent in front and divergent on the clypeus. Antennae as usual, the club small, equal to joints two to eight, with a short, close, even, erect pubescence on the margins and upper side in the male, with a few longer hairs intermixed; irregularly pubescent in the female. Prothorax slightly dilated at base in the male, as wide as the elytra, the hind angles more or less evidently carinate, sometimes very feebly so, side margins reaching a little beyond the middle. Anterior width about half that at base, which is about two-thirds greater than the length. Surface slightly convex, feebly bi-impressed at base, finely, sometimes rather sparsely punctate. Elytral striae fine, with fine, rather closely placed punctures; sutural interval finely, uniseriately punctate, the second and third confusedly punctate at base, becoming somewhat uniseriate behind; outer intervals becoming variolate punctate and coarser behind, on the ninth interval only evident posteriorly. Prosternum finely, sparsely punctate, striae slightly divergent in front; punctuation coarser at sides and outside the antennal grooves, also on the hind coxae and first and last ventrals. Male with elytra fringed at sides. Length 2 to 3 mm.

The broader, more robust form, the close, fine pubescence resembling that of *sericeus*, and the variolate punctuation of the intervals distinguish this from any of the forms of *chevrolati*. Some females with the prosternal striae feebly abbreviated have been referred to this species; such specimens will be difficult to separate from large specimens of *sericeus*, if they be really distinct.

Northern California, Oregon and Washington.

5. **Throscus sericeus** LeConte

Elongate oval, narrowed behind, pale reddish to dark castaneous, usually dull, sometimes feebly shining, with a very fine, prostrate pubescence, coarser hairs not obvious. Head convex, finely, closely punctate and bicarinate as usual. Antennae with club small, similar in form in the sexes, with short, even pubescence in the male. Prothorax evidently a little more dilated at base in the male, parallel, thence obliquely narrowed to apex; in the female the sides are broadly arcuate; side margin short, sometimes not quite reaching the middle; carinae of hind angles feebly evident; disk convex, broadly bi-impressed at base, finely, not closely punctate. Elytra finely striate, striae finely punctate, intervals variolate punctate except the sutural and second, the punctures becoming larger behind. Prosternum with the striae distinctly more or less abbreviated in front, finely sparsely punctate, punctuation generally as in *mandax*. Length 1.75 to 3 mm.

Var. **debilis** Horn

Prosternal striae shorter. This is hardly worthy of a name as it runs into *sericeus*.

This species varies almost as much as does *chevrolati*. Some specimens of the *debilis* form are more coarsely punctate above and below, and again the smaller specimens of *sericeus* are frequently very finely punctate. No sexual characters have been observed except the pubescent antennal club and the dilation of the hind angles of the pronotum in the male. Var. *debilis* is more northern—Oregon, Washington and Vancouver—while true *sericeus* occurs in Oregon, California, Arizona, New Mexico and Colorado.

# STUDIES IN THE AMERICAN EPHYDRIDAE (DIPTERA)

## II. A REVISION OF THE SPECIES OF THE GENERA NOTIPHILA AND DICHAETA

BY EZRA T. CRESSON, JR.

In the study of the cosmopolitan genus *Notiphila* the student will encounter some difficulty in trying to separate a few of the species, and it will soon become evident that a thoroughly exhaustive study will be necessary to establish their limits. The material upon which this paper is based contains over five hundred and fifty specimens, and is separable into twenty-three forms, which are given specific rank, although I recognize that some may be merely varieties or subspecies. Many of the forms are distinguished by characters which one would expect to find subject to variation, but the series representing these are very constant in such characters.

The present paper is, and must be, preliminary, but will serve as a foundation for a more exhaustive treatment when additional material can be studied. Introductory remarks, acknowledgments and general explanations will be found in the first paper of this series.[1]

I will add here that all material examined from Costa Rica was collected by Dr. Philip P. Calvert, and is in the collection of the Academy of Natural Sciences, Philadelphia, unless noted to the contrary. It will, therefore, be unnecessary to mention this fact in the lists of specimens examined.

### **NOTIPHILA** Fallen

1823. *Notiphila* Fallen, Dipt. Suec. Hydromyz., 7.

This is the type-genus of the Notiphilinae and forms with *Dichaeta* and *Paralimna* the group Notiphilae. This group is characterized by having erect extensor bristles on the middle tibiae.

[1] Trans. Amer. Ent. Soc., xlii, 101 to 124, (1916).

The validity of *Dichaeta* as a distinct genus is somewhat doubtful. *Paralimna*, however, is quite distinct, differing from *Notiphila* and *Dichaeta* in the extension of the costa to the fourth vein, whereas in the present genus it terminates at or slightly beyond the third. In general appearance *Hydrellia* resembles *Notiphila*, but the costal character will separate them at once.

*Generic Description.*—All the known species of this genus are opaque and more or less densely pruinose, excepting the abdomen. The macrochaetae are generally well developed. Eyes bare, vertically oval. Frons with a very strong, reclinate frontal bristle and a few proclinate orbital setulae; frontalia more or less distinct and darker in color. Face gently convex in profile with retreating epistoma; mesofacial area bare, flat, transversely convex below and weakly carinate above; facalia distinct and also slightly convex, bearing scattered setulae, and along its inner margin the usual facial bristles which are sometimes hair-like. Cheek with distinct bristle. Mouth-opening moderate, not gaping, with margin bare. Antennae with apically spinose second joint; third elongate; arista long plumose above.

Thoracic chaetotaxy: Dorsocentrals 1:1, prescutellar 2, post-alar 1, supra-alar 1, presutural 1, humeral 1, notopleural 2, mesopleural 2, sternopleural 1, scutellar 4. Abdomen with five segments in the male. In our species the halters are yellow and the abdominal markings consist of dark, medianly interrupted, basal bands on segments two to five. These bands sometimes dissolve into spots arranged in two or four longitudinal series, or may be entirely absent. Fifth segment of male usually differentiated, sometimes characteristically developed.

Legs simple, with middle tibiae bearing three or four erect extensor bristles: one at base, one at basal third, one at apical third and one sometimes near the apex. The basal segment of the posterior tarsi sometimes with one or more suberect black bristles below near base (described herein as the "tarsal fascicle"). Wings normal with costa extending to or little beyond tip of third vein.

*Genotype.*—*Notiphila cinerea* Fallen (Westwood, 1840).

In contradistinction to *Paralimna* this genus is rather heterogeneous in its composition, as mentioned above, although it contains some difficult species, so that, excepting those closely allied forms, the species are quite easy to distinguish. The females, however, will give more trouble. The sexes of most of the species are easily separable, the males in these having the fifth abdominal segment enlarged, convex apically, sometimes abnormally developed. The species of the interesting *furcata*-group, although simulating those of *Dichaeta* in the males, are truly Notiphiline in all other respects and are therefore placed in the present genus.

The known species of this genus readily divide into two well-marked groups, which are here given subgeneric rank. They are characterized by the number of extensor bristles on the middle tibiae and are very constant in this respect. The arrangement of the facial bristles and of the abdominal markings are also of some value, but are not as constant.

Systematically the species may be arranged as follows:

Middle tibiae with three extensor bristles (*Notiphila*).
Middle tibiae of male not ciliate beneath (*riparia*-group).
Thorax unicolorous, without irrorations or stripes.....**riparia**
Thorax more or less irrorated or striped.
Mesonotum irrorated.....**punctifera**
Mesonotum faintly, if at all striped.....**bicolor, erythrocera**
Mesonotum distinctly striped.....**facialis**
Middle tibiae of male ciliate beneath (*cinerea*-group).
Mesonotum, at least laterally, distinctly striped.
Abdomen of male normal, not arched.....**virgata**
Abdomen of male narrow, arched, with fifth segment markedly developed.....**vittata, nudipes**
Mesonotum not striped.
Abdomen ovate, with or without two series of triangular spots.
**loewi, floridensis**
Abdomen rounded, with or without series of elongate spots.
**biseriata, cognata, fulvimana**
Middle tibiae with four extensor bristles (*Agrolimna*).
Fifth abdominal segment of male convex above, not armed.
Mesonotum not striped.
Abdominal markings broad, not attenuating laterally, more or less shining.....**scalaris, atripes, occidentalis**
Abdominal bands attenuating laterally.....**olivacea, macrochaeta**
Mesonotum distinctly striped.....**pulchrifrons, frontalis**
Fifth abdominal segment of male concaved above, attenuated, and armed, at apex, with two long bristles.....**bispinosa, furcata**

## *Table of Species*

A. Middle tibiae with three extensors; facial bristles confined to lower half of face (*Notiphila*).

1. Bristles of legs weak and minute; abdomen of male shrunken on dorsum, and middle tibiae ciliate beneath (Nearctic species)....**nudipes** p. 43.
Bristles well developed.....2
2. Mesonotum distinctly striped, at least with a broad lateral stripe.....10
Mesonotum not distinctly striped.....3

3. Abdomen immaculate; middle tibiae of male ciliate....4
Abdomen with two series of spots....5
Abdomen with four series of spots, or banded....8
4. Tarsal fascicle black; facial bristles close, confined to lower third (Nearctic species)....**loewi** p. 44.
Tarsal fascicle yellow; facial bristles well separated, confined to lower half of face (Nearctic species)....**cognata** p. 46.
5. Abdominal spots triangular, not attaining apices of segments....6
Abdominal spots elongate, attaining apices of segments but not produced laterally; second costal section four times as long as third (Nearctic species)....**biseriata** p. 46.
Abdominal spots triangular, attaining apices and lateral margins; second costal section three times as long as third (Cuban species).
**fulvimana** p. 47.
6. Second antennal joint yellow; arista with 9 to 11 hairs; frons much broader than long; middle tibiae not ciliate....**erythrocera** p. 36.
Second joint black; arista with 6 to 7 hairs; frons not broader than long; middle tibiae of male ciliate....7
7. Face broad, silvery white; cheeks twice as broad as third antennal joint (South Florida species)....**floridensis** p. 46.
Face narrow, yellow or gray; cheeks not much broader than third antennal joint (Nearctic species)....**loewi** p. 44.
8. Mesonotum without any trace of stripes on dorsum; abdominal spots blackish and more or less shining (Nearctic species)....**riparia** p. 32.
Mesonotum with indications or suggestions of stripes; abdominal spots obscure or faintly shining....9
Mesonotum with brown irrorations at bases of setulae; abdominal spots brown, obscure or slightly shining (Neotropical species).
**punctifera** p. 34.
9. Second antennal joint and fore legs black (Nearctic species)..**bicolor** p. 35.
Second antennal joint and fore tibiae yellow....**erythrocera** p. 36.
10. Face with a median brown stripe; middle tibiae of male not ciliate. (Neotropical species)....**facialis** p. 38.
Face immaculate; tibiae normal.
Lateral mesonotal stripe broad; abdominal spots isolated or narrowly connected basally; abdomen of male arched, depressed on dorsum, with fifth segment much developed (Nearctic species)..**vittata** p. 42.
Lateral stripe narrow; abdominal spots broad and more or less connected basally; abdomen normal (Neotropical species)..**virgata** p. 40.

B. Middle tibiae with four extensors; facial bristles fine, series extending to foveal region (*Agrolimna*).
1. Antennae and palpi black....2
Palpi yellow....7
2. Tarsal fascicle black; mostly olivaceous species with rather distinct frontal stripes; abdominal bands attenuating laterally; arista with 8 to 10 hairs....3
Tarsal fascicle pale....4

3. Tarsal fascicle of male consisting of a long bristle, nearly as long as first tarsal joint; abdominal bands of female small, abbreviated laterally. **macrochaeta** p. 54.
   Tarsal fascicle consisting of a minute black bristle; abdominal bands of female broad, almost attaining lateral margins..... **atrisetis** p. 52.
4. Abdominal bands obscured and attenuating laterally; arista with 12 to 14 hairs..... **olivacea** p. 52.
   Abdominal bands broad, shining, not attenuating laterally; arista with 8 to 10 hairs.....5
5. Abdomen slender, elongate; tarsi black..... **atripes** p. 50.
   Abdomen ovate; tarsi more or less pale.....6
6. Western nearctic species..... **occidentalis** p. 51.
   Eastern nearctic species..... **scalaris** p. 49.
7. Frons and mesonotum distinctly striped.....8
   Frons and mesonotum not distinctly striped; sixth abdominal segment of male conical with two approximate, apical, upcurved bristles.....10
8. Dark abdominal bands broad and broadly attaining apical margins of segments (Neotropical species)..... **frontalis** p. 56.
   Dark bands not or narrowly attaining apical margins, sometimes reduced to spots.....9
9. Frontal stripes uelvety black..... var. **signata** p. 57.
   Frontal stripes obscured, not velvety black..... **pulchrifrons** p. 55.
10. Second antennal joint black; sixth abdominal segment of male with a long, cylindrical, bristle-bearing appendage..... **furcata** p. 59.
    Antennae yellow; sixth segment without appendage.... **bispinosa** p. 58.

### Subgenus **Notiphila**

The species comprising this subgenus are generally ochreous in color, becoming cinereous below, opaque; seldom are the dark abdominal markings shining. The facial bristles are usually stout, limited to three or four in a series, not or scarcely attaining the middle of the facial profile. In those having these bristles hair-like the series is more extended, thus showing a tendency to intergrade with species of the subgenus *Agrolimna*. In the present subgenus the antennae are generally, and the palpi are always, yellow or tawny. The abdomen is marked with brown spots, or in some species is immaculate; while on the other hand some have the spots more or less transversely connected, forming basal bands on the segments. However, these bands always have their posterior margins emarginated, or are constricted between where the spots normally are, and are more or less dilated at the middle longitudinal gray stripe. The middle femora of the male are more or less distinctly ciliate

beneath, and, in one group, their tibiae are also ciliate beneath with a comb-like series of short, erect setulae. In both sexes there are only three erect extensors on the middle tibiae, the fourth or preapical one being absent or very minute.

The species may be separated into two rather poorly defined groups, which are well worthy of note but hardly of nomenclatoral recognition. These groups are based wholly on male secondary sexual characters, namely, the ciliation of the middle femora and tibiae, the females apparently not showing any correlation. For this reason I have not considered the groups except in the arrangement of the species. They may be characterized as follows:

Middle tibiae not ciliate ..... *riparia*-group
Middle tibiae ciliate ..... *cinerea*-group

## The *riparia*-group

This group contains species which seem to be more generalized than any others in the genus. Some of the species are difficult to separate and it is probable I have been too radical in their treatment; but am at loss sometimes to decide whether or not a specimen or a small series represents a distinct species, or only an extreme variety of, or perhaps a subspecies of, another known or unknown species. My material, although the most extensive ever studied of the American species, is discouragingly lacking in large series of such forms. Consequently synonymy is liable to occur, but I prefer such to erroneous determinations or indiscriminate lumping.

The species belonging here have the middle femora of the male weakly, and their tibiae not at all, ciliate. It is rather a heterogenous group and may not stand as here considered.

**Notiphila riparia** Meigen

1830. *Notiphila riparia* Meigen, Syst. Beschr., vi, 65.

After comparing the American specimens with those of the European *riparia*, I can find no characters for specific differentiation, nor even of subspecific value. In comparison with our other species of this group, we find the present one more robust and with stouter bristles; the mesonotum is evenly colored, without any indication or suggestion of stripes, especially mesad of the intra-alar series, although isolated spots on the lateral margin and at the lateral roots of the scutellum, may be present. The

abdominal markings are nearly shining, very dark brown or nearly black, not overcast with pollen, but are never distinctly shining. This species is rather unique in that the sexes are not as easily determined as are the other species, on account of the similarity of the fifth abdominal segments of the two sexes, and there are no other secondary sexual characters that I can find.

*Description.*—♂. Black; antennae and palpi tawny; bases and apices of tibiae and all tarsi more yellowish; halteres yellow; wings yellowish hyaline with yellow veins; tarsal fascicle black.

Opaque; general color olive to buffy-olive becoming gray below. Thorax immaculate, evenly colored or with spot on lateral margin of mesonotum and large spot or stripe on mesopleura, brown; no irrorations. Abdomen more or less shining, especially the dark brown markings which are rather elongate and in four series, well separated, but not attaining apical margins; hairs and bristles, especially on apical margins, emitted from brown dots.

Frons much broader than long, in profile obliquely flattened; orbits parallel. Face slightly narrower, longer than broad, in profile flat above, convex below, or in general, weakly convex; foveae and carina weak; parafacials linear, scarcely dilating below; four stout bristles on lower half. Cheeks narrow, scarcely equalling third antennal joint in width. Antennae small with stout thorn; third joint nearly three times as long as second, subconical; arista long, with twelve to fourteen long hairs. Scutellum flat, broad apically. Abdomen ovate with subequal segments. Middle femora and tibiae weakly, if at all, ciliate; latter with three extensors. Wings narrow; second costal section one and a half to two times as long as third. All bristles long and stout. Length. —3.5 to 5 mm.

♀. Similar, excepting for femoral ciliation.

Described from Europe. The above description is based on the series examined as given below.

*Specimens Examined.*—3 ♂,11 ♀.

Massachusetts: Nantucket, VII, 20, 1910, 2 ♀, [B. S. N. H.].

New York: Ithaca, 1 ♂, 1 ♀, [C. U.].

New Jersey: Salt Meadows, VIII, (Wiedt), 2 ♀, [Harbeck].

Georgia: Billy's Island, Okeefenokee Swamp, VI, 1912, 1 ♂, [C. U.]. Prairie, Honey Island, Okeefenokee Swamp, VI, 1, 1912, 1 ♂, [C. U.]. Thalman, IV, 28, 1911, 1 ♀, [C. U.].

Ohio: Cincinnati, VII, 9 to 16, 1901, 1 ♀, [Ohio]. Kent. VI, 18 to 22, 1900, 1 ♀, [Ohio]. Sandusky, Cedar Point, VII, 8, 1901, 1 ♀, [Ohio]; VII, 18 to 20, 1904, 2 ♀, [Ohio].

*Variations.*—There is some little variation in size, in which respect the species contains the largest specimens I have seen belonging to the genus. The species intergrade nicely with *erythrocera*. The American specimens may vary slightly from

those of Europe in being somewhat darker, especially respecting the antennae and legs, and possibly the frons and face are slightly broader.

Before me is a female; Toronto, Ontario, Canada, VII, 4, 1913, (M. C. VanDuzee); which is evidently not conspecific with the above series, but I do not care to describe it as new, as it is a female. The general color is more yellowish; second antennal joint black; facial bristles weak; abdominal spots more connected at bases; fore tibiae and tarsi black. Evidently, however, it belongs to this group.

**Notiphila punctifera** new species

?1830. *Notiphila exotica* Wiedemann, Auss, Zweifl. Ins., ii, 590.
?1896. *Notiphila bellula* Williston, Trans. Ent. Soc. London, 1896, 390.

This and the following species of the group differ from *riparia* in their greater opacity, and the more or less irrorated or vittate mesonotum. The vittae, however, may not be distinct, but there are some indications or suggestions of such mesad of the intra-alar series. The abdomen is more opaque, with the markings not so dark and shining.

In the present species the frons is broad and the hairs of the arista numerous as in *riparia*, but the mesonotum is irrorated with brown dots at the bases of the setulae and shows faint vittae. It is closely related to, and may be a subspecies of, *erythrocera* Lw. Length.—3.5 to 4 mm.

*Holotype.*— ♀ ; Corumbá, Brazil, May, (H. H. Smith), [A. N. S. P. No. 6109]. *Paratypes.*—1 ♂, 1 ♀ ; topotypical.

*Specimens Examined.*—2 ♂, 3 ♀.
Brazil: Corumbá, May, (H. H. Smith), 1 ♂, 2 ♀, [A.N.S.P.].
Paraguay: San Bernardino, (Barbarczy), 1 ♂, 1 ♀, [H. N. M.].

*Synonymy.*—I think this will prove to be Williston's species, but cannot say this of Wiedemann's. The synonymy of the latter is based on the yellow palpi and antennae and the four series of abdominal spots. The examinations of the types will readily establish the true synonymy.

*Variations.*—I have also a specimen from Brazil (H. H. Smith), which has the facial bristles weaker and more hair-like, in series of four extending higher up on the face. The mesonotal vittae are more apparent, but the irrorations are less distinct. It was received from Prof. Williston under a manuscript name.

A female from Martinique, West Indies, VII, 26, (A. Busck), [U. S. N. M.], is doubtfully conspecific with the above series. Having seen only one specimen, the difference may be due to variation, on account of the rather poor condition of the specimen. The yellow antennae and legs are darker and the mesonotum more distinctly irrorated and the abdomen more shining. It suggests *N. decorata* Williston, excepting that the mesonotum is irrorated with brown.

**Notiphila bicolor** new species

Here we have a very unsatisfactory species, mainly on account of the lack of a good series. Its similarity to *erythrocera* is evident and of which it is possibly only a variety or subspecies. The study of a large series may reveal some variation and make it difficult to separate it from that species. In the type specimen there is noticeable contrast between the brown thorax and the gray abdomen. The second antennal joint and the fore legs are black.

*Description.*—♂. Black; base of third antennal joint, palpi, halteres, apices of femora, bases of fore tibiae, middle and hind tibiae, excepting preapical ring, and middle and hind tarsi, yellow or tawny; tarsal fascicle black; wings hyaline, veins yellowish.

Opaque; frons, mesonotum and scutellum, yellowish brown or old gold; frontal and facial orbits silvery; face gray, tinged with yellow. Cheeks, occiput, pleura, pectus, and abdomen, gray. Mesonotum with small, brown, presutural spot and a similar spot on mesopleura. Abdomen with a pair of elongate median and rounded lateral spots on segments two to five; the lateral spots diminishing until nearly obsolete on fifth segment. Femora faintly grayish.

Frons broad as long; orbits parallel. Face slightly narrower, concaved above; foveae and carina weak; about three moderately developed bristles on lower third of profile. Cheeks hardly as broad as third antennal joint. Spine of second antennal joint small; third joint large, straight above, convex below twice as long as second; arista with seven to eight hairs. Scutellum flat, broad apically. Abdomen ovate; segments four and five subequal in length. Middle femora of male sparingly, and their tibiae minutely, ciliate. Wings long, with second costal section two and a half times as long as third. Length. —3 mm.

*Holotype.*—♂; Columbia, Missouri, May 26 to June 8, 1906, (C. R. Crosby), [Cornell Univ.].

*Variation.*—Before me are two specimens (♀?) [Illinois] which seem to belong here, showing but little variation from the type. The arista, however, has nine hairs and the bristles of the face are finer and somewhat more numerous.

**Notiphila erythrocera** Loew

1878. *Notiphila erythrocera* Loew, Zeit. f. Ges. Naturw., 194.
?1830. *Notiphila difficilis* Weidemann, Auss. Zweifl. Ins., ii, 591.
1906. *Notiphila varia* Jones, Univ. Cal. Tech. Bull., i, 153.

Here we have a species, represented in my material by an extensive series, which is seemingly in the process of breaking up, there being much variation, especially in the markings and in the color of the antennae and legs; at present, however, I cannot find any satisfactory lines of demarcation between the various forms. This species is sometimes liable to be confused with its closely allied species, but not with any special one, and this fact is responsible for the possible synonymy suggested under those species. I do not doubt my determination of this species.

Specimens having the mesonotum faintly vittate suggest the recessive forms of *facialis;* while those having only two series of abdominal spots suggest species in the *cinerea*-group; while those with the more intense, less opaque, abdominal pattern are liable to be confused with *riparia.* However, in general there should be little difficulty in recognizing this species. The best distinguishing characters are the broad face, tawny or yellow second antennal joint, the size, number and position of the facial bristles, and the immaculate or faintly vittate mesonotum. These facial bristles are strong, two or three in number, limited to the lower third or fourth of the facial profile; the uppermost being hardly above the level of the buccal orbit. The general color is ochreous, even the browns and the dark areas are overcast with this color. The females should not be confused with those of *virgata,* which have the browns of the abdomen more or less shining and the mesonotum distinctly vittate. Rarely are the abdominal spots shining in this species, and the antennae are always pale, rarely brown or the second joint blackish. The median abdominal stripe is very conspicuous in certain aspects.

*Description.*—Black; antennae, palpi, halteres, apices of femora, middle and hind tibiae, and tarsi, yellow; fore tibiae and tarsi brown, rarely yellow; hind tibiae rarely brown medianly; tarsal fascicle black; wings yellow.

Opaque; head ochreous; frontalia and ocellar region darker; frons sometimes golden, and vittae obsolete or at times very marked in certain aspects. Face varying from gray to golden; second antennal joint seldom infuscate apically. Mesonotum brownish to yellowish olivaceous or golden, sometimes faintly vittate with brown. Scutellum concolorous or brownish on disk.

Pleura concolorous to gray below with brown mark on mesopleura. Abdomen concolorous to gray, generally with two or four series of brown spots, which vary in intensity and often coalescing into transverse bands, or all spots may be absent; hairs and bristles with basal brown dots. Cross veins of wings infuscate.

Frons as broad or broader than long; orbits nearly parallel. Face about three-fourths as broad as vertex, broad as long, weakly convex; foveae weak; carina rounded; facalia with one to three well developed bristles (rarely with four) which are as stout as those on cheeks. Cheeks as broad as third antennal joint. Spine of second antennal joint one-half as long as third; arista with ten to fourteen hairs. Scutellum flat, rounded apically. Genitalia inconspicuous. Middle femora of ♂ distinctly ciliate beneath. Length.—3.3 to 4.3 mm.

*Type.*— ♀ ; Cuba, (Gundlach), [Mus. Comp. Zool.?],

*Specimens Examined.*—47 ♂, 62 ♀.

District of Columbia: Oct. 30, (on grass), 1 ♀, [U. S. N. M.].

Georgia: Thalman, IV, 28, 1911, 4 ♂, 3 ♀, [C. U.].

Florida: Jacksonville, III, 31, 1913, 1 ♀, [C. U.]. St. Augustine, III, 9, 1 ♂, 1 ♀, [A. N. S. P.]. St. Petersburg, VIII, 12, 1910, (J. C. Bradley), 1 ♂, [C. U.]. Biscayne Bay, (Mrs. Slosson), 2 ♂, 1 ♀, [U. S. N. M.].

Louisiana: Cameron, VIII, 14 to 28, 1903, 3 ♂, 9 ♀, [Ohio and U. S. N. M.]. Slidell, VII, 2 to 6, 1905, 1 ♂, 1 ♀, [Ohio].

Texas: Galveston, May, (F. H. Snow), 2 ♀, [Kans.].

California: Riverside, Riverside County, V, 30, 1898, (B. J. Jones), 5 ♂. [Cal.]. Cotypes of *N. varia*.

Cuba: Havana, (Baker), 5 ♂, 5 ♀, [Johnson and Aldrich.].

Mexico: Tampico, XII, 6, (F. C. Bishopp), 1 ♂, [U. S. N. M.].

Guatemala: Livingston, II, 18, 1905, (C. C. Dean), 1 ♂, [U. S. N. M.]. Puerto Barrios, III, 3 to 4, 1905, (J. S. Hine), 2 ♀, [Ohio].

Nicaragua: Granada, (C. F. Baker), 1 ♂, [U. S. N. M.].

Costa Rica: Alajuela, 3100 ft. alt., IX, 15, 1909, (sweepings), 1 ♀. Bonnefil Farm, Rio Surubres, 800 ft. alt., X, 21, 1909, (sweepings), 1 ♂, 1 ♀. Cartago, V, 17, 1909, (along ditch), 3 ♂, 4 ♀ ; V, 25, 1909, (along ditch), 4 ♀ ; X, 10, 1909, (sweeping over mud), 1 ♀ ; X, 27, 1909, 1 ♂, 2 ♀ ; XI, 21, 1909, (sweeping over mud), 2 ♂, 1 ♀ ; XII, 12, 1909, (sweeping over mud), 1 ♂, 2 ♀. Laguna near Cartago, II, 26, 1910, 2 ♂, 2 ♀. El Alto, 4950 ft. alt., VII, 7, 1909, (on *Melastoma* tree flowers ?), 1 ♂, 8 ♀ ; (sweeping over swamp), 1 ♂, 2 ♀. Filadelfia, Rio Tempisque, I, 18, 1910, (on muddy beach), 1 ♂, 1 ♀. Guacimo, V, 6, 1909, 2 ♂. Juan Viñas, VII, 30, 1909, 5 ♂, 3 ♀. Peralta, VIII, 7, 1909, (sweeping near pool), 1 ♂, 2 ♀ ; III, 24, 1910, (sweeping over muddy road), 1 ♀. Turrucares, XII, 22, 1909, (sweeping over mud), 1 ♂, 1 ♀.

Panama: Bohio, Canal Zone, IV, 7, 1911, (A. H. Jennings), 2 ♂, 1 ♀, [U. S. N. M.].

Colombia: Baranquilla, III, 1912, (Ujhelyi), 1 ♂, [H. N. M.].

*Notes and Variations.*—The Cuban and Colombian specimens have the mesonotum more distinctly vittate than is usual, but I have seen no specimens in which these vittae were fully developed.

As will be noted from the above list, this species is neotropical in its distribution, and, judging from the number of specimens and localities mentioned, it is also a very common species within its range. The species seems to be limited to the northern part of the region, i. e., north of the equator. Towards Brazil and Paraguay it is probably represented by *punctifera*.

The specimens collected at El Alto, Costa Rica, on *Melastoma* tree flowers were probably collected over swamp. Dr. Calvert did some collecting at El Alto over swamp, and it is not unlikely that there was some mistake made in labelling either the catch or the specimens. Such is the natural inference from the habitat of the species.

This species has also been reported from Porto Rico (Roeder, in Stett. Ent. Zeit., 349, 1885).

*Synonymy.*—The synonymy of *Notiphila varia* Jones is certain, as I have carefully examined the cotypes of that species which are before me. The dark coloration occurring on the thorax, which is so minutely described by that author, is simply a stain caused by the moisture from the mounting medium; the specimens being glued on cardboard points.

The synonymy of *N. difficilis* Wied [South America] is a surmise. It is suggested by the entire yellowish color, and the abdomen having two series of spots; but the size given is small. Although Wiedemann does not specifically mention the color of the antennae it is assumed to be yellow, being covered by the general term yellow. Should the synonymy be proved beyond a doubt, Wiedemann's name, of course, has priority.

**Notiphila facialis** new species

This species in its typical form is unique and easily distinguished by the conspicuous median brown stripe on the face. But I have seen slight variations which suggest a possible intergradation with *erythrocera*. By this species we pass nicely into the next group through the vittate species *virgata*.

*Description.*—Black. Antennae, palpi, halteres, joints of fore legs, apices of femora, tibiae except preapical ring, and middle and hind tarsi, yellow; tarsal fascicle black. Wings hyaline.

Opaque. Frons, except orbits, dark brown or olivaceous, with stripes of black in certain aspects. Frontal and facial orbits white. Face light yellow with a well-defined median stripe extending from the carina to epistoma, brown. Cheeks and occiput whitish. Thorax gray, tinged with brown above. Mesonotum with conspicuous median vitta bifurcated posteriorly, a posteriorly abbreviated dorso-central, an anteriorly abbreviated intra-alar and a broad lateral vitta, brown, a narrow notopleural stripe and a large mesopleural spot or stripe, and a low sternopleural stripe, brown. Scutellum with two brown dorsal spots and a black lateral margin. Abdomen gray, tinged with yellow, and with four series of large brown irregular spots, more or less coalescing basally and the median pair generally attaining apices of segments.

Frons slightly broader than long, with orbits slightly converging. Face much narrower, twice as long as broad, flat in profile; parafacials scarcely dilated below; bristles hair-like, short, about four in the series which is confined to lower third of face. Cheeks hardly as broad as third antennal joint. Antennal spine rather short; arista with ten to twelve hairs. Scutellum flat. Apical segment of abdomen of male shining. Middle femora of male ciliate; their tibiae minutely so. Wings long; second costal section nearly twice as long as third. Length.—3.2 to 4 mm.

*Holotype.*—♂; Tabernilla, Canal Zone, Panama, April 27, 1907, (A. Busck), [U. S. N. M. No. 20724]. *Paratypes.*—2 ♂, 2 ♀; topotypical.

*Specimens Examined.*—7 ♂, 7 ♀.

Panama: Porto Bello, II, 15, 1911, (A. Busck), 1 ♀, [U. S. N. M.]. Tabernilla, Canal Zone, IV, 27, 1907, (A. Busck), 3 ♂, 2 ♀, [U. S. N. M.].

Brazil: Corumbá, (H. H. Smith), 1 ♀, [A. N. S. P.].

Paraguay: San Bernardino, II to III, 1906, (Babarczy), 4 ♂, 3 ♀, [H. N. M.].

*Variations.*—The specimens from Brazil and Paraguay vary somewhat from the typical series. The wings are broader, with a decided yellowish tinge, and the second costal section is hardly one and one-half times as long as the third. In the Paraguay specimens the facial stripe is narrow and sometimes nearly obsolete, but of the Brazil specimen it is normal, broad and distinct.

## The *cinerea*-group

This group, although typically very distinct, is, however, not sharply defined. The essential characters are the strongly ciliate middle femora and tibiae of the male. This ciliation, typically, is very distinct, of closely set bristles and hairs, which on the tibiae is of short, erect or suberect, more or less evenly arranged hairs. The tibial ciliation is sometimes difficult to dis-

cern and always require high magnification. The femoral ciliation, although also apparent in the *riparia*-group, is much more developed here, while the tibial ciliation is not at all developed in that group. The fifth segment of the male abdomen is differentiated, triangular, and convex apically.

I have examined specimens of the European *cinerea* Fallen, and have taken that species as the type of this group. *Cinerea* is also the type species of the genus.

**Notiphila virgata** Coquillett **Pl. I, figs. 1 to 3.**

1900 *Notiphila virgata* Coquillett, Proc. U. S. Nat. Mus., xxii, 259.

I place this species here, next to *erythrocera*, on account of the apparent intergradation of the two. In this group it is rather isolated by its vittate mesonotum, yellow antennal joint and quadriseriated abdominal design. On the other hand it is very distinct from *erythrocera*, and in general easy to distinguish, although the vittate individuals of that species are often confusing. The females may be difficult to separate from those of the recessive forms of *facialis*.

I have examined the type of this species.

*Description.*—Black; antennae except apex of third, and rarely the second, joint, palpi, halteres, knees, bases of fore tibiae and of their tarsi, middle and hind tibiae and their tarsi, yellow or tawny; tarsal fascicle black; wings brownish hyaline with pale veins.

Opaque; frons olivaceous to golden, with vittae and preocellar dash darker; face and cheeks light yellow, sericeous; occiput, pleura and femora gray. Mesonotum light olivaceous to golden brown with five darker dorsal and a broad lateral, stripe; mesopleura with large brown spot; scutellum with two discal spots. Abdomen gray with four series of large brown, subopaque spots, more or less coalescing on bases of segments; marginal bristles with basal brown dots; ventral lobes spotted.

Frons quadrate; orbits parallel. Face three-fourths as broad as vertex, slightly longer than broad, with two or three distinct bristles on lower fourth of profile; in profile, vertical, slightly visible above. Cheeks as broad as length of third antennal joint. Antennal spine minute; third joint slightly conical, rounded apically; arista with about nine hairs. Scutellum flat, trapezoidal, slightly rounded apically. Abdomen ovate, rather long; segments subequal; fifth convex, triangular. Middle femora and tibiae of male strongly ciliate. Wings long; second costal section twice as long as third. Length.—3 to 4 mm.

*Lectotype.*—♀; Vieques Island, Porto Rico, February, 1899, (A. Busck), [U. S. Nat. Mus. Type No. 4376]. (Present selection from cotypic series). *Paratypes.*—2 ♂; topotypical; 1 ♂,

Arroyo, Porto Rico, February, 1899, (A. Busck); 1 ♂, Bayamon, Porto Rico, January, 1899, (A. Busck); 1 ♀, Utuado, Porto Rico, January, 1899, (A. Busck).

*Specimens Examined.*—19 ♂, 22 ♀.

San Domingo: 1 ♀, [Kans.].

Porto Rico: Arroyo, II, 1899, (A. Busck), 1 ♂, [U. S. N. M.]. Bayamon, I, 1899, (A. Busck), 1 ♂, [U. S. N. M.]. Utuado, I, 1899, (A. Busck), 1 ♀, [U. S. N. M.]. Vieques Island, II, 1899, (A. Busck), 2 ♂, 1 ♀, [U. S. N. M.].

Martinique, West Indies: VII, 27, (A. Busck), 3 ♀, [U. S. N. M.].

Costa Rica: Alajuela, 3100 ft. alt., IX, 8, 1909, (sweeping over brook), 1 ♀. Cachi, near Rio Reventazon, 3450 ft. alt., III, 4, 1910, 1 ♂, 2 ♀. Cartago, V, 17, 1909, (along ditch), 2 ♂, 3 ♀; V, 25, 1909, (along ditch), 2 ♂; VII, 4, 1909, 1 ♀; X, 10, 1909, (sweeping over mud), 3 ♂, 2 ♀; X, 27, 1909, 1 ♀; XI, 21, 1909, (sweeping over mud), 1 ♂, 2 ♀; II, 19, 1910, (sweeping over mud), 1 ♂, 1 ♀. Juan Viñas, II, 14, 1910, 1 ♂. Peralta, III, 24, 1910, (sweeping over muddy stream), 2 ♀.

*Variations.*—The series examined show little variation in comparison to the number examined. The color sometimes becomes more golden and on the frons obscures the darker vittae. The face may be gray and the number of aristal hairs may be increased to twelve.

A female; Puerto Barrios, Guatemala, III, 3 to 14, 1905, (J. S. Hine), [Ohio]; evidently belongs near here. The face, however, is slightly broader with a slight brownish stripe in the middle below. In this respect it is apparently simulating *facialis*.

*Synonymy.*—There is some possibility of this being *Notiphila striata* Williston, but a few discrepancies are evident upon comparison with the description of that species. The original description of *striata* suggests the present species, except that there is no mention of the frontal vittae, or of the four series of abdominal spots. In these respects *striata* agrees with *erythrocera*, but differs in the distinctly vittate thorax not possessed by *erythrocera*.

Var. **pura** new variety

Similar to *virgata* but thorax immaculate.

*Type.*—♂; Tabernilla, Canal Zone, Panama, April 27, 1907, (A. Busck), [U. S. Nat. Mus., Type No. 20722].

This form suggests *erythrocera*, but has the middle femora and tibiae ciliate. It is certainly allied to *virgata*, of which I prefer to consider it a variety.

*Variation.*—A male bearing the same data as the type, differs in having the series of facial bristles more extended and the aristal hairs seven in number. There is also faint indications of thoracic maculation. A possible intergrade may invalidate this variety.

I have also a male, labeled "D. C., 8. 19. 99", [U. S. N. M.], which is not typical, but I hesitate to recognize it as a distinct species or variety upon such meager and uncertain data. It seems to simulate this variety, but the thorax shows faint maculation, the facial bristles are weaker, in more extended series, and the fore tibiae and tarsi are entirely infuscate.

**Notiphila vittata** Loew

1862. *Notiphila vittata* Loew, Mon. Dipt. N. Am., i, 136.

This and the following species form a small group which I have not otherwise recognized. Although typical of the *cinerea* group, these species have the male abdomen elongate, arched and cylindrical, and sunken on the dorsum; not flattened and ovate as is usual with the other species. The females, on the other hand, are very similar, in fact they are difficult to separate from those of *virgata*. In the latter species, however, the face is broader, the abdominal spots are more isolated, with less tendency to coalesce into bands; the lateral stripe of the mesonotum is broad, completely traversing the sutural depression and extending to the supra-alar region.

My specimens agree so well with the original description that I have no doubt of the determination.

*Description.*—Similar to *virgata* in color and general markings. Frons not vittate; mesonotum faintly and narrowly vittate medianly, but with a broad lateral stripe extending over the sutural depression to the supra-alar region; mesopleura also vittate above and below; scutellum with lateral margins brown. Abdomen with four series of spots of which the median pair are elongate, generally attaining apices of segments, sometimes narrowly connected basally with the lateral spots on segments two, three and five; ventral lobes also with series of spots.

Structurally similar to *nudipes*, but the bristles of legs normal and well developed. Length.—3 mm.

*Type.*— ♀ ; Middle States, [Mus. Comp. Zoöl.].

*Specimens Examined.*—3 ♂, 7 ♀.

New Jersey: Cape May, VI, 7, 1914, (H. S. Harbeck), 1 ♀, [Harbeck].

Maryland: Pope's Creek, V, 22, 1896, 1 ♂, 2 ♀, [A. N. S. P. and H. N. M.].

District of Columbia: VIII, 19, 1899, 1 ♀, [Ohio].

Ohio: Sandusky, VI, 30, 1900, 3 ♀, [Ohio]; VII, 1914, 1 ♀, [Ohio]. Wauseon, VIII, 25, 1902, 1 ♂, 1 ♀, [Ohio].

Illinois: Havana, Thompson's Lake, IX, 1, 1910, (Sandy beach), 1 ♀, [Ill.].
Missouri: Columbia, V, 26 to VI, 8, 1906, (C. R. Crosby), 1 ♂, [Corn, U.].

*Variations.*—The female from Cape May, New Jersey, has the third antennal joint black and the mesonotum distinctly vittate.

**Notiphila nudipes** new species

?1862. *Notiphila bella* Loew, Mon. Dipt. N. Am., i, 135.

This species has both sexes peculiar in that the legs are nearly destitute of, or with very poorly developed, bristles. The species is also distinctive in the general cinereous tinge overcasting the entire insect, excepting, of course, the brown markings and the facial color.

It is separated from *vittata* by the undeveloped leg bristles, stouter femora and more triangularly shaped head in the male. The leg bristles are reduced to setulae, which are evenly developed over all surfaces, not longer in certain places than in others.

*Description.*—Black; palpi, sometimes third antennal joint except apical margin, halteres, apices of femora, broad bases and narrow apices of tibiae and tarsi, tawny or yellow; tarsal fasciele pale.

Opaque, olive gray pruinose. Frons blackish, with median area and especially orbits lighter. Face yellow. Mesonotum rarely vittate medianly, but with broad lateral stripe, including presutural and supra-alar bristles, and another intra-alar stripe continuous on lateral scutellar margins, brown; mesopleura sometimes with stripe above. Abdomen of male with a pair of large, brown triangles on segments three to five, attaining apical margins of segments medianly, and attenuating laterally; of female with emarginated basal bands dilating medianly; second segment with two to four rounded, isolated spots.

Frons subhorizontal, well protruding at antennae, flattened, longer than broad; orbits parallel. Face as broad as frons, in profile straight and retreating; carina more prominent than orbits; bristles weak. Cheeks hardly as broad as length of third antennal joint; lower occiput very conspicuous. Spine of second antennal joint minute; third, broad apically; arista with seven to eight hairs. Scutellum broadly truncate, flat. Abdomen elongate, cylindrical, arcuate, sunken on dorsum of segments two to four; lateral margins rounded; segment five subconical, broadly truncated, much longer than four. Legs stout, all bristles reduced to setulae or are wanting; middle femora of male suleate, cilia very short, erect on their tibiae. Length.—3 to 4 mm.

*Holotype.*—♂; Woodbury, New Jersey, VI, 7. 1896, (C. W. Johnson), [A. N. S. P. No. 6110]. *Paratypes.*—2 ♂; topotypical.

*Specimens Examined.*—5 ♂, 3 ♀.

New Jersey: Manahawkin, V, 30, 1910, (H. S. Harbeck), 3 ♀, [Harbeck]. Woodbury, VI, 7, 1897, (C. W. Johnson), 3 ♂, [A. N. S. P. and H. N. M.].

Ohio: Akron, VI, 23, 3 ♂, [Ohio].

*Notes.*—Of the specimens examined, the males have the third antennal joint mostly yellow and the pleural markings obsolete.

Although the series I have is small it is noticed that there are no specimens of both sexes from the same locality. The only females I have seen are the three from Manahawkin, New Jersey. Before seeing these I could not satisfactory characterize the species except in the males, and had about concluded that the females were inseparable from those of *vittata*. As soon as the Manahawkin specimens were examined the stout, weakly setulose legs at once indicated their relationship.

*Synonymy.*—I suspect this to be *N. bella* of Loew, mainly on account of the ash gray color and the broad mesonotal stripes, but it is strange that Loew does not mention the peculiar development of the abdomen. On the other hand my specimens have only a spot on the upper part of the pleura, and the abdominal spots are arranged in two series or the lateral ones are short and small.

**Notiphila loewi** new name

?1862. *Notiphila unicolor* Loew, Mon. Dipt. N. Am., i, 137, (nec Walker, 1860).

This species begins a group with non-vittate thorax, and hair-like facial bristles in more extended series. The abdominal markings are reduced to two median series of triangular spots, or the abdomen may be immaculate. The present species has the fore tibiae and tarsi black and the middle and hind ones yellow. The cilia of the male middle tibiae is not well developed, the bristles or hairs being more recumbent. Their femora, however, are distinctly and densely ciliate.

*Description.*—♂. Black; base of third antennal joint, palpi, halteres, knees, tibiae and tarsi except median ring on hind tibiae and apical joint of tarsi, tawny or yellow. Fore tibiae and tarsi, black. Tarsal fascicle black. Wings brownish.

Opaque, light olivaceous with ochreous tinge including femora; sometimes dorsal surfaces darker to brownish, and pleura and metanotum lighter. Frons darker with light orbits; vittae indistinct. Face and cheeks yellow or ochreous to whitish. Mesonotum faintly vittate; mesopleura with small spot or thorax entirely immaculate. Abdomen with a median pair of brownish triangular spots on segments; sometimes these extend to lateral margin, are limited to a pair on third segment only, or are entirely wanting.

Frons subquadrate; orbits slightly converging. Face three-fourths as broad as vertex, one-fourth longer than broad, with shallow foveae and a weak,

sharp carina; with three to four weak bristly hairs on lower half of profile; profile convex, slightly more prominent than orbits. Cheeks as broad as length of third antennal joint. Antennal spine weak; third joint broad apically; arista with seven to eight hairs. Thoracic bristles and setulae distinct, normal. Scutellum flat, trapezoidal. Abdomen ovate; segments consecutively increasing in length; fifth triangular, acute, convex. Middle femora distinctly and densely ciliate, especially apical half; tibial cilia appressed. Wings long; second costal section twice as long as third. Length.—3.2 to 3.5 mm.

♀. Similar but frons somewhat faintly vittate; bristles of face and especially of abdomen stronger.

*Holotype.*—♂; Sandusky, Cedar Point, Ohio, July 16, 1902, [Ohio]. *Paratypes.*—1 ♂, 9 ♀; topotypical.

*Specimens Examined.*—6 ♂ 12 ♀.

Massachusetts: Eastham, VI, 27, 1904, (C. W. Johnson), 1 ♂, [B. S. N. H.]. Nantucket, VII, 20, 1910, (G. M. Allen), 1 ♂, 2 ♀, [B. S. N. H.].

Ohio: Sandusky, Cedar Point, VII, 5, 1902, 2 ♂, [Ohio]; VII, 9, 1902, 1 ♀, [Ohio]; VII, 16, 1902, 2 ♂, 9 ♀, [Ohio and Kans.].

*Variations.*—The specimens with immaculate abdomen surely belong here, as there is much variation in the extent of the abdominal markings in the series examined; these sometimes reduced to only a pair on the third segment, or, as in the Nantucket specimens, the abdomen is wholly immaculate. It is not probable that the absence or presence of spots alone is of specific importance.

I have also a female; Mt. Constitution, Orcas Island, Washington, VII, 7, 1905, (J. M. Aldrich), [Aldrich]; which is similar to those in the above series with the following exceptions: The dark abdominal markings are more developed, attaining the apices of the segments, and on the third also attaining the lateral margins; the frons and face are somewhat broader and the third costal section is longer. The discovery of the male of this form will probably reveal some specific differences, but for the present I will place this individual here.

*Synonymy.*—The above quoted synonymy, I think, is correct, but Loew's name cannot stand and being uncertain as to the correct identification of *unicolor* Loew, I am supplying a new species for my series.

**Notiphila floridensis** new species

This form is similar in many respects to *loewi*, and I am not sure that it is a good species, but it will probably deserve subspecific recognition.

*Description.*—Similar to *loewi*. Frontal orbits slightly converging. Face white, sericeous, with three to four distinct bristles on lower half of profile; profile concaved above. Cheeks twice as broad as third antennal joint. Abdomen gray, contrasting with the ochreous mesonotum; segments three and four with median pairs of triangular spots. All tibiae and tarsi yellow, but fore tibiae sometimes discolored medianly; cilia of middle tibiae of male suberect. Wings grayish. Length.—3.2 mm.

*Holotype.*—♂; South Florida, (Robertson), [U. S. Nat. Mus. No. 20723]. *Paratype.*—1 ♀; topotypical.

**Notiphila biseriata** new species

In this we have another form similar to *loewi* but differing in the characters given below.

*Description.*—Similar to *loewi* but abdomen broader, more rounded and the spots large, not triangular, with little or no tendency to broaden along bases of segments. General color wholly olivaceous with frons dark and face yellow. Mesonotum and pleura immaculate. Middle tibiae at apices and hind tibiae except extreme bases, black, as are also the apices of their tarsi.

Facial bristles noticeably more separated, so that the series extends higher towards antennae. Antennal arista with eight to nine hairs. Ciliae of middle tibiae of male more erect and of their femora more dense. Wings, especially second vein much longer, with second costal section four times as long as third. Length.—4 mm.

*Holotype.*—♂; Sandusky, Ohio. [Ohio Univ. Coll.].

A female; Drayton Island, Florida, V, 9, 1894; labeled "N. unicolor Lw.," which I have seen in the U. S. National Museum collection, may belong here, but I have not compared specimens.

**Notiphila cognata** new species

This species is unique in having the tarsal fascicle yellow. If this character continues to hold, as it has done in the other species, the present species can thus be distinguished from all others belonging to this group. Unfortunately, I have seen only the type of this form. The general habitus is similar to *biseriata* and the species probably belongs near it. The abdominal markings may, in an extended series, be found to be arranged in four series of spots, as the type has suggestions of lateral spots.

This form seems to be the nearest relative of the European *cinerea* Fallen, we have in America. I have seen European specimens of *cinerea*.

*Description.*—Black; base of third antennal joint, halteres and knees, and all tibiae and tarsi, including tarsal fascicle, yellow. Wings clear hyaline.

Opaque. Frons blackish olivaceous with orbits narrowly lighter. Face and cheeks whitish, sericeous. Occiput, pleura, abdomen and femora, grayish olivaceous. Mesonotum and scutellum olivaceous, faintly if at all vittate.

Frons broad as long, orbits converging. Face two-thirds as broad as vertex, twice as long as broad; foveae weak in profile, scarcely visible above; bristles hair-like in series extending above middle of profile. Cheeks twice as broad as third antennal joint. Antennal spine minute; third joint broadly rounded apically; arista with six hairs. Mesonotal bristles strong but setulae weak. Scutellum flat, rounded apically. Abdomen ovate, segments subequal. Middle femora ciliate and cilia of their tibiae erect. Wings long; second costal section twice as long as third Length.—3.5 mm.

*Holotype.*—♂; Manahawkin, New Jersey, V, 30, 1910, (H. S. Harbeck), [A. N. S. P. No. 6111].

The type specimen was determined by Coquillett as *N. unicolor* Lw.

**Notiphila fulvimana** new species

This species, represented in my material by the typical pair alone, is rather unique and occupies a somewhat isolated position. It has a small extensor near the apex of the middle tibiae of the male, thus suggesting a relationship to the species of the subgenus *Agrolimna*. The maculation of the abdomen is characteristic, and the species, as at present known, is distinguished by this. The ciliation of the middle femora is weakly developed and scarcely distinguishable. The systematic position of the species is rather difficult to determine with so little material, but I think it should belong here, near *Agrolimna*.

*Description.*—♂. Black; base of third antennal joint, halteres, apices of femora, all tibiae and tarsi, and tarsal fascicle, black; wings tawny or yellow, uniformly hyaline with yellow veins.

Opaque; yellowish inclined to gray, or olive-lake, not much lighter below. Frontal vittae darker; orbits and face more yellowish. No brownish markings except on the abdomen. These are in the form of a pair of concaved triangles on segments three to four, with their extremities attaining the apical and lateral margins of the segments; segment five has only a median pair of elongated spots. The median stripe well marked. Femora thinly coated with gray.

Frons as broad as long, in profile convex; orbits parallel. Face nearly as broad as vertex, longer than broad, in profile convex; foveae and carina distinct; parafacials narrow; bristles hair-like, four or more on lower third or half. Cheeks as broad as length of third antennal joint. Second antennal

spine short; third joint ovate; arista with eight hairs. Abdomen broad; segment four much longer than three; five much shorter; genital segment well developed. Legs sparsely bristled, with a suggestion of a fourth extensor bristle on middle tibiae. Wings long; second costal section two or three times as long as third. Length.—3.5 to 4 mm.

♀. Similar, but only three extensors on middle tibiae.

*Holotype.*—♂; San Diego de los Banos, Cuba, [U. S. N. M. No. 20725]. *Paratype.*—♀; topotypical.

**Agrolimna** new subgenus

This subgenus is proposed for the reception of those species having the facial bristles hair-like, in series extending well above the middle of the facial profile, and the middle tibiae furnished with four extensor bristles, i. e., the preapical extensor present and well developed. The species falling here, at least those known to the author, also have the palpi and antennae generally black; middle femora and tibiae never ciliate. The abdominal markings are generally in the form of bands which are sometimes dilated medianly, or, may be limited to two median series of triangular spots. However, the bands do not break up into four spots as is often the case with the species of the previous subgenus.

The present subgenus contains several well defined groups which I think should be recognized. The type species of this subgenus is *Notiphila scalaris* Loew.

The *scalaris*-group

It is very probable that the European *uliginosa* Haliday, will come within this group, in which case the group name, if thought desirable, can be changed to conform. I have not seen that species, but the fact that it possesses the tibial character of four extensors at once includes it within this subgenus. It contains a larger number of forms than either of the other two groups. The species as included here are in some cases unsatisfactorily separated, and perhaps a few of them may prove to be synonyms.

The characteristics of this group may be considered negatively. The abdomen of the male is normal, not armed apically; frons and mesonotum not vittate. In other words it is the residual group of this subgenus and may ultimately prove to be complex.

**Notiphila scalaris** Loew

1862. *Notiphila scalaris* Loew, Mon. Dipt. N. Am., i, 134.

In this species we have the typical North American form belonging to the division of this group, possessing black antennae and palpi. It is distinguished from its allies by the obscure frontal vittae and the broad black abdominal bands. These bands are shining and seldom dilated medianly or noticeably attenuated laterally, but continue over on the ventral lobes in their full width. From *occidentalis* it may be difficult to separate the present species when the fauna from westward of the Mississippi Valley, especially that of the eastern slope of the Rocky Mountains, is more thoroughly worked over in this genus.

I think my determination of this species is correct.

*Description.*—Black; middle and hind tarsi tawny; fore tarsi brown or black, only tawny at the articulations; tarsal fascicle yellow, rarely black. Halteres yellow.

Opaque. Frons generally unicolorous blackish, or orbits and triangle somewhat gray or yellowish, rarely with broad orbits contrasting with black vittae; lunule yellowish white. Face golden to grayish yellow; orbits scarcely lighter. Cheeks concolorous. Mesonotum light brown to grayish brown, only faintly and inconspicuously vittate; mesopleura with distinct brown horizontal stripe or spot. Abdomen gray to light brown, segments two to four with broad shining brown or black basal bands, which are rarely attenuated laterally or attaining apical margins at middle, generally of equal width to lateral margins and extending over on the ventral lobes; segment two rarely immaculate. Apical segment of male entirely shining black or brown, or, with lateral gray spots, but rarely with a median gray stripe. Wings brownish with yellow veins, which are more or less clouded with fuscous or yellow, especially the post-cross vein.

Eyes vertical, attenuated below. Frons as long as broad; orbits parallel or converging. Face two-thirds as broad as vertex, twice as long as broad; carina obtuse or in some aspects appearing sharp, visible in profile, especially of female; bristles hair-like, in series complete to foveae. Cheeks as broad as length of third antennal joint. Antennal spine hardly one-half as long as third joint; arista with nine or more hairs. Middle femora with two, rarely three, bristles on the apical half of anterior surface. Length.—3.5 to 4 mm.

*Types.*—♂, ♀; Middle States, (Osten Sacken), [Mus. Comp. Zoöl.]

*Specimens Examined.*—124 ♂ and ♀.

Canada: Sandford, Ontario, VI, 1906, (C. R. Crosby), 3 ♀, [C. U.]. Toronto, Ontario, VII, 4, 1913, (M. C. VanDuzee), 1 ♀, [Van D.].

New Hampshire: Franconia, (A. T. Slosson), 1 ♂, [U. S. N. M.].

Massachusetts: Blue Hills, VI, 6, (C. W. Johnson), 1 ♀, [B. S. N. H.]. Hyannis Point, VII, 4, (C. W. Johnson), 1 ♀, [B. S. N. H.].

New York: (E. B. Southwick), 1 ♂, 1 ♀, [U. S. N. M.]. Beaverkill, Sullivan County, VIII, 5, 1909, (E. T. Cresson, Jr.), 1 ♀, [A. N. S. P.]. Caroline to Harford, Tompkins County, VI, 15, 1904, 1 ♂, [C. U.]. Dryden Lake, Tompkins County, VI, 16, 1904, 10 ♂, 8 ♀, [C. U.]. Ellis to Slaterville, Tompkins County, VI, 13, 1904, 2 ♀, [C. U.]. Gowanda, Cattaraugus County, VI, 15, 1913, (M. C. Van Duzee), 1 ♀, [Van D.]. McLean, Tompkins County, VII, 2 to 3, 1904, 4 ♂, 2 ♀, [C. U.]. Malloryville, Tompkins County, VI, 18 to 20, 1904, 1 ♂, [C. U.]. Mud Creek, Tompkins County, VII, 17 to 18, 1904, 4 ♂, 9 ♀, [C. U.]. Slaterville to Caroline, Tompkins County, VI, 14, 1904, 2 ♂, 6 ♀, [C. U.]. Woodwardia Bog, Tompkins County, 1 ♂, 3 ♀, [C. U.].

New Jersey: Clementon, V, 30, 1905, (H. S. Harbeck), 1, [Harbeck]. Manahawkin, IX, 5, 1910, (H. S. Harbeck) 1, [Harbeck]. Point Pleasant, VI, 21, 1914, (H. S. Harbeck), 1, [Harbeck].

Pennsylvania: Germantown, VIII, 5, 1905, (H. S. Harbeck), 2, [Harbeck]. McConnellsburg, Fulton County, VI, 4, 1905, (Stone), 1 ♀, 1 ♀, [A. N. S. P.]. Philadelphia, V, 30, 1891, (C. W. Johnson), 4 ♀, [H. N. M.]. Pocono Lake, VII, 25, 1912, (H. S. Harbeck), 3, [Harbeck]. Roxborough, VI, 11, 1911, (H. S. Harbeck), 8, [Harbeck].

Maryland: College Park, V, 15, 1913, (F. Knab), 1 ♀, [U. S. N. M.].

District of Columbia: Rock Creek, VI, 15, 1913, (R. C. Shannon), 1 ♂, [U. S. N. M.].

West Virginia: Fairmont, VI, 22, 1908, (E. T. Cresson, Jr.), 1 ♂, 1 ♀, [A. N. S. P.]

Ohio: Akron, VI, 19, 1 ♂, 3 ♀, [Ohio]. Columbus, V, 18, 4 ♂, 1 ♀, [Ohio]. Hawkins, Summit County, VI, 27, 1902, 1 ♂, 3 ♀, [Ohio]. Hinckley, Medina County, VI, 20, 1903, 5 ♂, 10 ♀, [Ohio]. Sandusky, VI, 30, 1900, 2 ♀, [Ohio]; VII, 1914, 1 ♀. Cedar Point, Sandusky, VI, 8, 1902, 1 ♀; VII, 1, 1904, 1 ♂ [all Ohio].

Illinois: Algonquin, 2 ♀, [U. S. N. M.].

*Notes.*—This we may call the typical species of the group, having the face yellow, rarely gray, and the veins of the wings also yellow. The abdominal design is very pronounced when the median stripe and the apical margins are gray instead of yellow, and the dark bands very shining.

**Notiphila atripes** new species

Allied to *scalaris* but hardly synonymous. It may be distinguished by the elongated abdomen of the male and the black tarsi.

*Description of Male.*—Similar to *scalaris*. Black; halteres yellow. Frontal vittae black, distinct. Arista with eight hairs. Thorax immaculate or mesopleura slightly stained. Abdominal markings subopaque, broad, leaving narrow median stripe and apical margins of segments gray; segment five entirely shining. Abdomen unusually narrowed and elongate. Length.—3 to 5 mm.

♀. Similar but segment five with median stripe. The abdomen also longer than usual.

*Holotype.*—♂; Beverly, Massachusetts, VI, 15, 1875, (Burgess), [U. S. N. M. No. 20726]. *Paratypes.*—2 ♀; topotypical.

**Notiphila occidentalis** new species

?1868. *Notiphila quadrisetosa* Thomson, Kong. Svensk. F. Eugenies Resa, Dipt., 594.

This species although very similar to *scalaris* is not identical. However it may prove to be only a subspecies. The difference is not well marked and is rather difficult to describe.

*Description.*—Similar to *scalaris* Loew, but more robust, darker and tarsi sometimes entirely black. Frons more uniformally blackened; the lighter, grayish orbits and triangle indistinct or obliterated. Face broader in proportion to its length, being nearly as broad as long, bluish white to yellowish gray; parafacials wider and lighter. Cheeks much broader. Mesonotum uniformly dark olivaceous, if at all only faintly and narrowly vittate; mesopleura faintly marked. The brown abdominal bands shining and generally poorly defined. Middle femora generally with three stout bristles on anterior surface near apex. Wings brownish or blackish, in some aspects faintly opalescent; all veins blackish with last section of fourth noticeably weaker. Length. —3.5 to 4.

*Holotype.*—♂; Alameda (salt marshes), California, May 5, 1908, (E. T. Cresson, Jr.), [A. N. S. P. No. 6112]. *Paratypes.*—2 ♀; topotypical.

*Specimens Examined.*—3 ♂, 10 ♀.

Idaho, (all J. M. Aldrich), [all Aldrich]: Grangeville, VI, 27, 1907, 1 ♀. Juliaetta, 2 ♀. Moscow, 1 ♀. Potlatch, VI, 20, 1907, 1 ♀. White Bird, VII, 3, 1907, 1 ♀.

Nevada: Wells, V, 6, 1915, (M. C. VanDuzee), 1 ♂, [VanDuzee].

Oregon: Beaver Creek, Newport, 1 ♀, [Aldrich].

California: Alameda (salt marshes), V, 5, 1908, 1 ♂, (E. T. Cresson, Jr.], 1 ♂, [A. N. S. P.]; V, 26, 1915, (M. C. VanDuzee), 3 ♀, [VanDuzee]. Berkeley, V, 12, 1915, (M. C. VanDuzee), 1 ♀, [VanDuzee]. Berkeley Hills, Alameda County, IV, 11, 1908, (E. T. Cresson, Jr.), 1 ♂, 2 ♀, [A. N. S. P.]. Palo Alto (salt marshes), IV, 26, 1906, 1 ♀, [Aldrich].

*Variation.*—A female, labeled "12 mi. N. W. of Lusk, Wyo. July 1895, U of K. Lot 431," [Kans.], may belong to a distinct species or subspecies, or is an intergrade. The frons is vittate; the face yellow, slightly narrower; all tarsi entirely black.

*Synonymy.*—The above synonymy is probably correct. This species is apparently the most abundant occurring on the Pacific coast region that agrees with Thomson's description, but it is

not the only one in my material which will. Until the types are compared or examined by a competent student, I hesitate to use Thomson's name.

Var. **minima** new variety

Smaller than the typical form (2.5 mm.). Thorax uniformly greenish gray without any suggestion of stripes or spots on the dorsum or pleura. Abdominal dark bands obscured, but not attenuating laterally; bases of tarsi pale; second costal section twice as long as third.

*Holotype.*—♂; Jemez Mountains, New Mexico, IX, 10, 1914, (J. Woodgate), [A. N. S. P. No. 6108]. *Paratype.*—1 ♂; topotypical.

I cannot consider this more than a variety of the common western species.

**Notiphila atrisetis** new species

Similar to *macrochaeta* both in color and structure, differing in the tarsal fascicle of the male below normal in length, minute. Furthermore the fore tarsi are entirely black and the dark abdominal bands broader and more shining, especially in the females, thus suggesting *occidentalis*. This form also averages slightly larger than *macrochaeta*. Length.—3.5 to 4 mm.

*Holotype.*—♂; Desert Edge, San Diego County, California, April 17, 1915, (M. C. VanDuzee), [A. N. S. P. No. 6115]. *Paratypes.*—1 ♂, 3 ♀; topotypical.

This form is likely to be confused with *occidentalis* and *olivacea*, if the color of the tarsal fascicle is not given attention. The females are difficult to separate from those of *macrochaeta*, but the dark abdominal bands seem to be broader and more shining in this species. Considering the larger size and general appearance, besides the characters mentioned above, I cannot treat this form as a variety of any known species.

A male and female from Great Salt Lake, Utah, VI, 8, 1915, (M. C. VanDuzee), also seem to belong here. They apparently are identical with the typical series.

**Notiphila olivacea** new species

This and the following species belong to a division of the *scalaris* group differing from that including *scalaris* in being more brownish or greenish, the abdominal bands less developed and the frons and mesonotum more noticeably vittate. This species is likely to be confused with some of the forms of *scalaris*, but I cannot consider it synonymous, although its limits are not satisfactorily established at present. The vittate frons, distinct when

seen from above, the olivaceous abdomen with the more opaque bands becoming narrower laterally, and the yellow tarsi, especially of the middle and hind legs, are the characters that seem to be of most value. The species seems to be very similar to the European *uliginosa* Haliday, which I have not seen, but is probably distinct. The females are difficult to separate from those of *macrochaeta*, so the description and notes under that species should be consulted.

*Description.*—♂. Black; halteres, base of wings, middle and hind tarsi, yellow or tawny. Tarsal fascicle yellow. Wings hyaline with yellow or brownish tinge and yellow veins.

Opaque: ochreous or olivaceous above to cinereous below. The two broad frontal vittae and dash below ocellus, blackish. Face golden yellow, sericeous; cheeks and occiput gray. Mesonotum, scutellum and pleura immaculate or with faint brown markings. Abdominal segments three to four with narrow opaque or subopaque brown basal bands, which are slightly dilated medianly and attenuated laterally, rarely attaining apices of segments; segment five shining black with median and lateral gray stripe. Femora and tibiae grayish. Length.—4 to 5 mm.

*Holotype.*—♂; Sandusky, Ohio, July, 1914, [Ohio Univ. Coll.]. *Paratypes.*—2 ♂, 6 ♀; topotypical.

*Specimens Examined.*—13 ♂, 21 ♀.

Canada: Toronto, Ontario, VII, 4, 1913, (M. C. VanDuzee), 2 ♂, 3 ♀, [VanDuzee].

Massachusetts: Barnstable, VII, 9, 1 ♂, [B. S. N. H.]. Nantucket, VII, 20, 1910, 2 ♂, [B. S. N. H.]. Provincetown, VI, 24, 1904, (C. W. Johnson), 3 ♂, [B. S. N. H.].

New York: VI, 23, 1893, (E. B. Southwick), 2 ♀, [U. S. N. M.]. Ithaca, 1 ♀, [C. U.]; VII, 16, 1905, 1 ♀, [Johnson].

New Jersey: Cape May, VI, 17, 1914, (H. S. Harbeck), 1 ♀, [Harbeck]. Manahawkin, VIII, 3, 1912, (H. S. Harbeck), 1 ♀, [Harbeck]. West Orange, VI, 1 ♀, [Harbeck].

Ohio: Sandusky, VI, 30, 1 ♀, [Ohio]; VII, 1914, 3 ♂, 6 ♀, [Ohio].

Illinois: Havana, Thompson's Lake, IX, 1, 1910, (sandy beach), 1 ♂, [Ill.]. Payette, VIII, 27, 1907, (E. G. Titus) 1 ♂, [Johnson].

?Texas: Galveston, V, (F. H. Snow), 2 ♀, [Kans.].

?Mexico: Guadalajara, VI, 24, 1907, (McClendon), 1 ♀, [A. N. S. P.].

*Variations.*—A female, "12 m. N. W. of Lusk, Wyoming, Jul. 1895," [Kans.], may not belong here and so is not included in the above list. It is more uniformly grayish with abdominal spots nearly obsolete. The Mexican specimen may prove to belong to another species, but I cannot differentiate it from the others.

*Note.*—In working over this species preparatory to submitting this paper for publication, it was discovered that I had labeled the two specimens from Texas as *olivacea* whereas they may be *macrochacta*. These have been returned to the University of Kansas and anyone working over that collection in this group should see if my labels are intact and correct the determination if wrong.

Var. **aenigma** new variety

Very similar to *olivacea* and doubtfully distinct, but probably deserving varietal recognition. The salient characters are the maculation of the mesopleura and the more or less distinct vittation of the mesonotum.

*Description.*—Similar to *olivacea* with fore tarsi tawny; wing veins more or less faintly clouded. Face pale yellow; mesonotum with three or five more or less distinct dorsal, and a broad distinct lateral, vittae, brown; mesopleura with distinct brown spot or band. Abdominal brown bands dilated medianly and attaining lateral margins.

*Holotype.*—♂; Seattle, Washington, VII, 15, 1901, [A. N. S. P. No. 6113].

*Variations.*—The following specimens I have included here with more or less doubt, and it is not improbable than some may represent other varieties. These being females may account for the variations from the type.

Three females: Mt. Constitution, Orcas Island, Washington, July 7, 1905, [Aldrich]. These are stouter in build, the color design more distinct, face broader and the arista with fourteen hairs. The scutellum is smaller, the brown abdominal bands rather shining, the third costal section shorter and the veins more noticeably clouded.

A female; Elma, New York, August 24, 1913, (M. C. VanDuzee), [VanDuzee]; has narrower frons and face, the former quadrate. The brown abdominal bands are broad and shining, hardly dilated or attenuated; veins not clouded.

*Synonymy.*—This may be *decorus* Williston, but I have not seen representatives of that species and therefore will not consider the possibility.

**Notiphila macrochaeta** Loew Pl. I, fig. 4.

1878. *Notiphila macrochaeta* Loew, Zeit. f. Ges. Natur., 1878, 192.

In general appearance this species differs little, if at all, from *olivacea*. However, it may be distinguished by the black bristle

in the tarsal fascicle, which in the male is a very long bristle, more than a half as long as the basal joint.

I have not seen the type of this species.

*Description.*—Similar to *olivacea*. Smaller (3 to 4 mm.); frontal vittae sometimes narrow or may be obscured; arista with eight to ten hairs. Tarsal fascicle with black bristle, which of the male is very long, more than half as long as basal joint of tarsi; of female not longer than the accompanying yellow bristles, but is situated more on the inner than flexor side of the joint, and is sometimes difficult to see. Wings hyaline, clear, not yellow tinged; second costal section twice as long as third.

*Type.*—♂; Texas, (Belfrage), [Mus. Comp. Zoölogy ?].

*Specimens Examined.*—4 ♂, 12 ♀.

South Dakota: Brookings, 1 ♂, 1 ♀, [Aldrich].

Kansas: Clay County, 1 ♀, [C. U.].

Texas: Austin?, X, 1899, 1 ♂, [Wash.]. Plano, (E. S. Tucker; at night), 1 ♀, [Kans.]. Galveston, V, (F. H. Snow), 1 ♂, 3 ♀, [Kans.].

Arizona: Bill Williams Fork, VIII, (F. H. Snow), 1 ♀, [Kans.].

California: Coalinga, Fresno County, VI, 1 to 3, 1907, (J. C. Bradley), 1 ♀, [C. U.]. Mesa Grande, Russian River, IX, 30, 1906, (J. C. Bradley), 2 ♀, [C. U.]. Stanford University, X, 1 ♂, 1 ♀, [S. U.]. Visalia, (Culbertson), 1 ♀, [Aldrich].

The species seems to be limited to the states west of the Mississippi River.

The *pulchrifrons*-group.

A seemingly well-defined group, although based primarily on the color pattern, which consists of distinct frontal and mesonotal stripes. Those of the frons, especially, are sometimes velvety black, contrasting beautifully with the gray or yellowish tinged orbits and triangle. I know only the following three species, which are not entirely satisfactory, and the study of more material may reduce these to two or even one. The group may then prove to be untenable.

**Notiphila pulchrifrons** Loew

1878. *Notiphila pulchrifrons* Loew, Berl., Ent. Zeit., xvi, 102 (Cent. x, 84).

This species, although not so distinctly marked as the others, however, possesses the group characters. It is readily distinguished from the others by the third antennal joint, middle and hind tibiae being yellowish; also by the vittation which is more subdued, not so intensely black on the frons, and the abdominal markings are sometimes reduced to two series of spots.

I do not doubt my determination of this species.

*Description.*—Black; Antennae especially third joint, palpi, halteres, fore coxae, bases and apices of middle and hind tibiae, and their tarsi except apices, yellow; fore tibiae and tarsi, brown, sometimes yellow; post tarsal fascicle yellow. Wings yellowish hyaline, with yellow veins.

Opaque, olive gray to yellow on head. Frons with two broad, obscured vittae and a dash below ocellus, black. Face sericeous, grayish to yellowish or golden, sometimes with two dark stripes. Mesonotum with brown vittae as follows: one narrow median, bifurcated posteriorly and joining the broader dorso-centrals and then continuing on the scutellum; a post intra-alar and another containing the presutural and supra-alar bristles, interrupted at suture; mesopleura at most with a small spot. Abdomen gray or yellowish; bases of segments broadly brown or with only a pair of triangular spots not attaining their apices. Femora gray.

Frons quadrate, orbits parallel or slightly converging; orbital bristles minute. Face one-half as broad as vertex, twice as long as broad, in profile convex below; foveae long and deep with carina rounded; para-facials narrow, concentric. Cheeks one-half as long as third antennal joint. Antennae short with distinct spine; arista with ten to twelve hairs. Scutellum flat, broadly truncate. Second costal section of wing nearly twice as long as third. Length.—2.5 to 3 mm.

*Type.*—♂; Texas (Belfrage), [Museum of Comparative Zoölogy Coll.]

*Specimens Examined.*—9 ♂, 15 ♀.

Texas: Austin, X, 20, 1 ♀, [Wash.]. Waco, (Belfrage), 1 ♂, 1 ♀, [U. S. N. M.].

Arizona: Bill Williams Fork, VIII, (F. H. Snow), 4 ♂, 8 ♀, [Kans.]. Oak Creek Canyon, 6000 ft. alt., VIII, (F. H. Snow), 1 ♀, [Kans.].

California: Bakersfield, Kern County, IX, 9, 1898, 1 ♂, 1, ♀, [Cal.]. Los Angeles, V, 1, 1915, (M. C. VanDuzee), 1 ♂, [VanDuzee]. San Diego County, desert edge, IV, 17, 1915, (M. C. VanDuzee), 1 ♂, 2 ♀, [VanDuzee]. Three Rivers, (Culbertson), 2 ♂, 1 ♀, [Aldrich]. Visalia, (Culbertson), 1 ♀, [Aldrich].

New Mexico: Jemez Mountains, V, 14, 1914 (S. Woodgate) 1 ♂, 1 ♀, [Harbeck].

**Notiphila frontalis** Coquillett

1897. *Notiphila pulchrifrons* Williston, Kans. Univ. Quart. vi, 5, (nec Loew, 1872).

1904. *Notiphila frontalis* Coquillett, Proc. Ent. Soc. Wash., vi, 97.

Similar to *N. pulchrifrons* but the design more intense, especially the frontal vittae more distinct and velvety black; in general appearance, a darker species. The broad abdominal bands attaining the apices of the segments medianly, are characteristic. This is one of the prettiest species of the genus, with its velvety black frontal vittae and golden face and orbits.

I have seen the type of this species.

*Description.*—Meso-frontal triangle brown at vertex, becoming silvery anteriorly; vittae broad, velvety black (dorsal aspect), reaching little beyond base of antennae, leaving narrow orbital lines. Face golden yellow, sometimes with dark stripes; lunule golden. Antennae brownish or black, with base of third joint paler. Mesonotum distinctly vittate; the median and intra-alar vittae more or less coalescing; the lateral one complete over suture. Mesopleura with distinct stripe. Abdominal bands very broad and attaining apices of segments medianly, giving the abdomen the appearance of being dark opaque brown, with a complete mesal stripe and apical angles of segments two to five, gray or yellowish brown; ventral lobes yellowish with a series of large brown dots. Tibiae annulated with black or brown; fore tarsi brown. Length.—2.5 to 4 mm.

*Lectotype.*—♂; Managua, Nicaragua, (F. C. Baker), [U. S. N. M. No. 7805]. (Present selection.) *Paratypes.*—1 ♂; topotypical. 1 ♀; Granada, Nicaragua, [all U. S. N. M.].

*Specimens Examined.*—9 ♂, 6 ♀.

Nicaragua: Managua, (F. C. Baker), 2 ♂, [U. S. N. M.]. Granada, (F. C. Baker), 1 ♀, [U. N. S. N. M.].

Costa Rica: Banana River, XI, 9, 1909, (sweeping at upper reservoir, 100 ft. alt.), 1 ♂, 1 ♀. Cartago, V, 17, 1909, (along ditch), 1 ♂, 1 ♀; V, 25, 1909, (along ditch), 1 ♀; VII, 4, 1909, 1 ♂, 1 ♀; V, 10, 1909, (sweeping over mud), 1 ♂; VI, 21, 1909, (sweeping over mud), 1 ♂; II, 19, 1910, (sweeping over mud), 1 ♀. Turrucares, XII, 22, 1909, (sweeping over mud), 2 ♂.

*Variation.*—The series examined show very little variation, and this is mostly in the extent of the pale coloration of the legs, the tibiae sometimes being almost entirely black.

*Synonymy.*—No doubt Williston's *pulchrifrons* is this species, although his types were not examined by me. It is strange that Dr. Williston overlooked Loew's name and that Mr. Coquillett did not recognize Williston's species.

Var. **signata** new variety

This form can hardly be considered a distinct species, although in some respects one is inclined to treat it as such. I believe it to be a northern form of *frontalis*.

*Description.*—Similar to *frontalis* but averaging smaller. In general it is more grayish than yellow. Palpi sometimes with bases dark. Antennae darker; the dark facial vittae more distinct and orbits silvery in contrast. The brown bases of abdominal segments not so broadly occupying the apices at the medial stripe. All tibiae black, or their bases and joints pale. Length.—2 to 2.5 mm.

*Holotype.*—♂; Thalman, Georgia, April 28, 1911, [Cornell Coll.]. *Paratypes.*—2 ♂, 4 ♀; topotypical.

*Specimens Examined.*—3 ♂, 5 ♀.

Maryland: Chesapeake Beach, VII, 27, 1913, (R. C. Shannon), 1 ♀, [U. S. N. M.].

Georgia: Thalman, IV, 28, 1911, 3 ♂, 4 ♀, [Cornell].

## The *furcata*-group

This group is distinguished by the character heretofore considered peculiar to the genus *Dichaeta*, that is, the tuberculate spinose development of the fifth abdominal segment of the males. This character is responsible for the author of one of its two species describing it as a *Dichaeta*. I will discuss the generic value of this character under the genus *Dichaeta*, but will say that as the present species, both male and female, are typically Notiphiline in all other respects, I cannot consider the character of generic importance. The females are readily separated from all other species of *Agrolimna* by the yellow palpi and non- or obscurely vittate frons and mesonotum. There are only two species known to me belonging here, and I do not think there are any described representatives in other parts of the world.

**Notiphila bispinosa** new species Pl. I, fig. 5.

Similar to *furcata* Coquillett. Antennae yellow. Tibiae of male tawny with median infuscation; of female black with extremities pale. Fifth abdominal segment of male without long tubercle, but the two stout bristles are emitted from the subconical apex of the segment. The face is somewhat more sharply carinate. The two species should not be confused if notice is taken of the color of the antennae.

*Holotype.*—♂; Barnegat City Junction, New Jersey, August 11, 1910, (H. S. Harbeck), [A. N. S. P. No. 6114]. *Paratype.*—1 ♂; topotypical.

*Specimens Examined.*—8 ♂, 24 ♀ and 10 ♂ and ♀.

Maine: Machias, VII, 17, (C. W. Johnson), 3 ♀, [B. S. N. H.].

Massachusetts: 4 ♂, 5 ♀, [U. S. N. M.]. Eastham, VI, 27, (C. W. Johnson), 2 ♀, [B. S. N. H.]. New Bedford, 1 ♀, [B. S. N. H.]. Woods Hole, VII, 24, (C. W. Johnson), 1 ♂, 2 ♀, [B. S. N. H.].

Rhode Island: Button Wood, VII, 25, 1911, 1 ♀, [B. S. N. H.].

New Jersey: Anglesea, 1 ♀, [A. N. S. P.]. Barnegat City, VII, 11, 1910, (H. S. Harbeck), 5, [Harbeck]. Barnegat City Junction, VIII, 11, 1910, 3, [Harbeck]. Cape May, VI, 4, 1 ♀, [A. N. S. P.]; VI, 22, 2 ♀, [Johnson]; VI, 7, 1914, (H. S. Harbeck), 1, [Harbeck]. Stone Harbor, VIII, 8, 1909, (H. S. Harbeck), 1, [Harbeck].

Maryland: Dorchester County, near Lloyds, VII, 10, 1907, (H. S. Barber), 1 ♀, [U. S. N. M.].

Florida: St. Augustine, III, 9, 1 ♂, [A. N. S. P.]; III, 14, 2 ♀, [Johnson]; X, 20, 1 ♀, [Johnson].

Louisiana: Cameron, VIII, 14 to 28, 1903, 3 ♂, 1 ♀, [Ohio].

*Synonomy.*—I have seen specimens of this species which were determined by Coquillett as *Dichaeta carinata* Loew, but these cannot be that species if Loew's description is followed. The antennae here are entirely yellow and I have not seen any suggestions of infuscation.

**Notiphila furcata** Coquillett Pl. I, fig. 6.

1902. *Dichaeta furcata* Coquillett, Journ. N. Y. Ent. Soc., x, 182.
?1853. *Notiphila transversa* Walker, Ins. Saund., i, 407.

In this species the antennae are mostly black, especially the second joint. The male has the fifth abdominal segment attenuating into a long cylindrical tubercle, which bears on its apex the two stout bristles.

I have examined the type of this species.

*Description.*—Black; palpi, base of third antennal joint, knees, and tarsi tawny, (fore tarsi sometimes brownish); halteres whitish. Wings hyaline with pale veins.

Opaque, cinereous to yellowish. Frons faintly vittate with black; orbits white. Face silvery to opaque black, depending upon the angle of vision. Mesonotum faintly and narrowly vittate with brown; mesopleura with brown spot. Bases of abdominal segments broadly subopaque brown, broadly dilated and interrupted medianly except on fifth of male; also with brown dots at bases of the larger bristles; fifth segment of male shining black with a lateral cinereous spot.

Frons convex, hardly broader than long, orbits parallel. Face nearly the width of vertex, more than twice as long as broad; carina weak, not visible in profile; bristles hair-like, in series extending to foveae. Cheeks narrow. Antennal spine distinct; arista with about ten hairs. Scutellum long as broad and broadly truncate. Abdomen with fourth segment longest and broadest, having about ten, very long, submarginal bristles; segment five short, truncate with a subapical, dorsal, cylindrical tubercle, nearly as long as the segment, bearing at its apex two long, stout bristles and on its lateral surfaces numerous long hairs. Second costal section of wings hardly twice as long as third. Length.—4 to 5 mm.

♀. Similar but face not so flat, with carina visible in profile. Fifth abdominal segment marked as fourth.

*Lectotype.*—♂; Biscayne Bay, Florida, (Mrs. Slosson), [U. S. N. M. No. 6640]. (Present selection.)

*Specimens Examined.*—7 ♂, 12 ♀.

Florida: Biscayne Bay, (Slosson), 3 ♂, 2 ♀, [U. S. N. M.]. Lake Worth, (Slosson), 1 ♂, 1 ♀, [U. S. N. M.]. St. Augustine, III. 15 to 20, 1 ♂, 2 ♀, [H. N. M.]; 1 ♀, [A. N. S. P.]; III, 20, (U. of K. Lot 958), 2 ♀, [Kans.].

Louisiana: Cameron, VIII, 14 to 28, 1903, 1 ♂, 4 ♀, [Ohio]. Slidell, VII, 2 to 6, 1905, 1 ♂, [Ohio].

The typical series contained two males and three females from Biscayne Bay and Lake Worth, Florida. There are five males and three females in the U. S. Museum collection from these localities, so it is impossible to distinguish the original series.

This species seems to be confined to the southern Atlantic and Gulf coasts.

*Synonomy.*—I have a suspicion that this may be *N. transversa* Walker, and also *N. carinata* Coquillett, but I hardly think the latter is probable.

*Species described under Notiphila which are not recognized or are synonymized in the material studied.*

In the study of a large amount of material which represents many species or forms, it is difficult to recognize with certainty many of the described species, especially in the groups in which the forms are not well marked or are subject to much variation. So many of the species, especially of authors who were not well acquainted with the family, are poorly or superficially described, and it is these which give us the most trouble. In working up a revision of a family from such a mass of material as I have been studying, it is, in my opinion, poor policy to try to recognize species from such poor or insufficient descriptions, if there is any doubt involved. The types in such cases, and in fact in all cases where possible, should be examined. I have therefore refrained from using names of doubtful species. If I am not reasonably certain of a described species I prefer to ignore it, until its type is examined, and more fully described or noted by an authority. I have been unable to examine Loew's types and so am compelled to ignore some of his names. When I am able to study them the species can then be located among those treated in this revision, thus involving but simple synonymy.

In hopes of being able to fix the status of Walker's species I sent, some time ago, to Mr. E. E. Austen of the British Museum of Natural History, some specimens of Ephydridae which seemed to agree, or nearly so, with Walker's descriptions. Mr. Austen kindly sent me notes on such of Walker's types as were available, and these have been valuable to me.

Following is a list of such unrecognized species, accompanied by notes as to their possible or probable relationships and synonymy.

**N. alboclavata** Bigot
1888. Miss. Scient, Cap. Horn., Dipt. vi, 41, (Cape Horn).

If this is a Notiphiline it is unique in having the coxae and femora yellow.

**N. argentata** Walker
1856. Ins. Saund. v, 407, (United States).

This belongs to the genus *Brachydeutera*.

**N. avia** Loew
1878. Zeit. f. Ges. Naturw., li, 193, (Hudson Bay Territory).

This seems to be allied to *loewi*. My material is lacking in any series from central Canada.

**N. bella** Loew
1862. Mon. Dipt. N. Amer., i, 135, (Middle States).

See the synonymy under *nudipes*.

**N. bellula** Williston
1896. Trans. Ent. Soc. London, 1896, 390, (St. Vincent).

See the synonymical note under *punctifera*.

**N. brasiliensis** Walker
1856. Dipt. Saund., i, 408, (Brazil).

This is not a *Notiphila*, judging from the length of the antennae as described.

**N. carinata** Loew
1862. Mon. Dipt. N. Am., i, 137, (Middle States).

The description of this species, based on a female, suggests *furcata*. I hardly think it could be associated with *riparia*.

**N. costalis** Walker
1856. Dipt. Saund., i, 408, (Brazil).

This evidently does not belong here. The long antennae, the "row of bristles along each eye" and the maculate wings are not characteristic of this genus. The description suggests *Scatella* or an ally.

**N. decorata** Williston
1896. Trans. Ent. Soc. London, 1896, 389, (St. Vincent).

The black second joint of antennae, the yellow base of third and the quadriseriated abdominal marking suggests affinities with *vittata* Loew.

**N. decoris** Williston
1893. N. Amer. Fauna, vii, 258, (Panamint Valley, California).

The description suggests species of *Agrolimna*, probably allied to *occidentalis* or *olivacea*.

**N. difficilis** Wiedemann
1830. Ausser. Zwiefl. Ins., ii, 591, (South America).

This may prove to be synonymous with *erythrocera*. The entire yellow color, with two series of abdominal spots, suggests that species.

**N. exotica** Wiedemann
1830. Ausser. Zwiefl. Ins., ii, 590, (Montevideo).

The yellow color, especially of the antennae and palpi, which are assumed to be this color, and the four series of abdominal spots, suggests *punctifera*.

**N. producta** Walker
1849. List Br. Mus., iv, 1099, (Hudson Bay).

This species, according to Mr. E. E. Austen, is the same as *Ephydra octonotata* Walker, which belongs to the genus *Parydra*, judging from Austen's notes.

**N. pulchrifrons** Williston
1897. Kans. Univ. Quart., vi, 5, (Brazil).

Synonym of *frontalis*.

**N. quadrisetosa** Thomson
1868. Eugen. Resa, Dipt., 594, (California).

This may prove to be the same as my *occidentalis*. The description will cover several of the forms I have from the west coast region.

**N. repleta** Walker
1849. List of Br. Mus., iv, 1099, (Martin's Falls).

Mr. Austen reports that this species belongs to the *Helomyzidae*.

**N. solita** Walker
1856. Dipt. Saund., i, 406, (United States).

Evidently a Notiphilid sens. strict., belonging to the quadriseriated abdomen group between *riparia* and *bella*. Mr. Austen, comparing the type with some *erythrocera* I sent him, says it is similar. *Erythrocera*, however, is rarely found in the United States. From Austen's suggestions I am inclined to consider it conspecific with our *riparia*.

**N. striata** Williston
1897. Kans. Univ. Quart., vi, 5, (Brazil).

See note on the synonymy of *virgata*.

**N. triangulifera** Schiner
1868. Reise Novara, Dipt., 241, (South America)

The description of this species suggests affinities to *olivacea* in the black antennae and tibiae, and the abdominal spots in two series. I do not know of any non-vittate *Agrolimna* from South America. On the other hand it may be allied to the species of the *cinerea* group, near *loewi* or *biseriata*, or, not improbably, allied to *floridensis*.

**N. transversa** Walker
1856. Dipt. Saund., i, 407, (United States).

Reference to this species may be found under *furcata*.

**N. unicolor** Loew
1862. Mon. Dipt. N. Amer., i, 137.

See *loewi*.

**N. varia** Jones
1906. Univ. Cal. Tech. Bull. i, 153, (California).

Synonym of *erythrocera*.

**DICHAETA** Meigen

1830. *Dichaeta* Meigen, Syst. Beschr., vi, 61.

This genus was originally based on the spinose development of the apical abdominal segment of the male. As this character is not of generic value, we have to resort to other less marked characters. It is not an altogether satisfactory genus, but I have been unable to find any tendency to intergrade with its allies. The only possible apparent associate is *Paralimna decipiens*, a possibility which should not be overlooked. As the species are known at present there is no trouble in limiting the genus.

It is placed with *Notiphila* in the group Notiphilae, and may be distinguished from that genus by the dark color and more shining abdomen of its species. Structurally it is distinguished by the strongly developed proclinate frontal orbital bristle, and, as suggested by Becker,[2] by the form of the facalia, which are hardly distinguished as longitudinal areas, but more as a ridge, so that the bristles are very close to the parafacial grove, while in *Notiphila* these bristles are separated from the grove by the full width of the broad facalia. Regarding the development of the

[2] Berl. Ent. Zeit., xli, 105, (1891).

male abdomen, the study of the species of the *furcata*-group of *Notiphila* will soon convince one that such characters are of no generic value. The species of that group do not in any way resemble the species of this genus, except in the spinose development of the male abdomen.

*Description.*—Dark, robust species, similar to *Notiphila* in most of its characters. Differing as follows: The anterior proclinate fronto-orbital bristle stout and well developed. Face flattened or weakly carinate above, with the median area below broader in proportion to the facalia and orbits; the facalia is very narrow, distinguished as a ridge hardly wider than the bases of the three to four stout facial bristles. The pleura has a more or less stout, upcurved bristle just above the fore coxae; the abdomen is more shining, sometimes polished, with at most only the apical margins of the segments faintly lighter in color; fifth segment of the males of all known species is more or less conically developed, often into a cylindrical prolongation or tubercle bearing two long, approximated, up-curved bristles at the tip; apical margin of fourth segment more or less reflexed, with a subapical series of very long bristles. Middle femora of both sexes with three extensors.

*Genotype.*—*Notiphila caudata* Fallen (monotypic).

*Notes.*—The study I have given my material convinces me that the amount of development of the conical apex of the fifth abdominal segment, and the number of bristles on the fourth of the males of this genus are of no specific value. I have a series of twenty-six males showing all intergrades between a simple conically shaped segment, and that with a long, cylindrical tubercle as long as the segment, and from six to thirteen bristles on the fourth segment. In this series I find that the number of hairs on the arista also varies inconsistently. Therefore Loew's *brevicauda*, if not distinct in other respects, is probably merely a synonym of *caudata*. As *brevicauda* was described from Europe, and not having seen specimens, I am not prepared to certify this synonymy. Becker does not given any characters which are not invalidated by the above mentioned study, so no help can be derived from that source. The extremes of my series show slight variation in size and color; the *brevicauda* form being smaller, darker and more shining, while the other extreme is more opaque and varied with light marks and stripes. However these differences are not constant in either form. There is also no correlation in the geographical distribution, as either form may be found in the same locality. The females are similar in every respect.

**Dichaeta caudata** Fallen Pl. II, figs. 7 to 11.

1813. *Notiphila caudata* Fallen, Acta Holm., 1813, 249.

1830. *Dichaeta caudata* Meigen, Syst Beschr., vi, 62, (lviii, 1–6).

?1860. *Dichaeta brevicauda* Loew, Neu. Beitr., vii, 5.

*Description.*—Black; palpi apically, third antennal joint rarely at base, and tarsi, tawny; fore tarsi sometimes dark; halteres yellow. Wings hyaline with veins, especially posterior cross vein, clouded.

Opaque, abdomen and mesonotum somewhat shining, brownish pruinose; face rarely golden. Occiput, thorax anteriorly, anterior rudiments of four mesonotal vittae, pleural spot, apices and median stripe of abdominal segments, more or less obscure grayish or olivaceous.

Eyes vertical. Frons convex, broader than long with orbits parallel. Face vertical in profile, flattened or weakly convexed, nearly as broad as vertex, about twice as long as broad, weakly if at all carinate. Two to four stout bristles on lower half. Cheeks hardly as broad as third antennal joint. Antennal spine strong, nearly as long as third joint; third joint rounded apically; arista with eight to twelve hairs. Scutellum flat. Abdomen elongate ovate; segments successively increasing in length. Wings as figured. Length.—3 to 4 mm.

*Type.*—Described from Europe.

*Specimens Examined.*—26 ♂, 24 ♀.

Canada: Toronto, Ontario, VII, 4, 1913, (M. C. VanDuzee), 1 ♀, [VanD.]. Oxbow, Saskatchewan, V, 15, 1907, (F. Knab), 1 ♂, [U. S. N. M.].

Massachusetts: Provincetown, VI, 25, 1904, (C. W. Johnson), 2 ♂, 2 ♀, [B. S. N. H., & Kans.].

Connecticut: (S. W. Williston), 1 ♀, [Kans.]. New Haven, VII, 27, 1907, (P. L. Butrick), 1 ♂, [B. S. N. H.].

Pennsylvania: Swarthmore, IV, 21, 1907, (E. T. Cresson, Jr.), 3 ♀, [Cress.]; V, 4, 1907, (E. T. C. Jr.), 1 ♂, [Cress.].

New Jersey: Clementon, V, 5, 1907, 2 ♀, [A. N. S. P.].

Maryland: Bay Ridge, VIII, 20, (N. Banks), 1 ♂, [Banks]. Cabin John Bridge, IV, 23, 1914, (R. C. Shannon), 2 ♀, [U. S. N. M.]. Chesapeake Beach, VII, 27, 1913, (R. C. Shannon), 3 ♂, 2 ♀, [U. S. N. M.]. Glymont, V, 25, 1896, 3 ♂, [Johnson & Kans.]. Near Plummer's Island, V, 4, 1915, (R. C. Shannon), 1 ♂, [U. S. N. M.]. District of Columbia, VIII, 19 to 30, 1899, 2 ♂, 1 ♀, [Ohio]. Rock Creek, District of Columbia, X, 26, 1913, (R. C. Shannon), 2 ♂, [U. S. N. M.].

Virginia: Dead Run, Fairfax County, XI, 18, 1913, 1 ♀; IV, 18, 1915, 1 ♀; V, 23, 1915, 1 ♀; all (R. C. Shannon), all [U. S. N. M.]. Rosslyn, IV, 23, 1913, 1 ♂, 1 ♀, V, 8, 1913, 1 ♀, all (R. C. Shannon), all [U. S. N. M.].

Ohio, all [Ohio]: Ashtabula, 1 ♀. Medina, V, 21, 1 ♀. Sandusky, VII, 1914, 1 ♂. Wauseon, VIII, 25 to IX, 17, 1902, 3 ♂.

Illinois: McHenry County, IX, 1903, 1 ♀, [Wash.].

North Dakota: Fargo, V, 10, 1901, 3 ♂, 1 ♀, [Ohio].

Idaho: Potlatch, VI, 20, 1907, (J. M. Aldrich), 1 ♀, [Aldrich].

Oregon: Oregon City, IX, 1 ♂, [Wash.].

*Variations and Synonymy.*—See notes under the generic discussion.

Var. **atriventris** Cresson

1915. *Dichaeta atriventris* Cresson, Ent. News., xxvi, 68

I doubt if this is a distinct species. The additions to the series of *caudata*, coming to hand since the publication of this form, reveal the tendency of some individuals to become unicolorous and shining on the thorax. A good series of typical specimens of this form may show characters not known at present, which will warrant specific recognition. This variety is distinguished by its small size, unicolorous shining black abdomen, and hyaline wings, which have no trace of clouding on the veins. Length.—3 mm.

*Holotype.*—♂; Colorado Springs, Colorado, 5915 ft. alt., August, (E. S. Tucker), [Kans.]. *Paratype.*—1 ♂; topotypical.

Before me are also two females; Yosemite Valley, V, 22, 1908, (E. T. Cresson, Jr.), [A. N. S. P.]; which I also place here, there being no variation worthy of note.

## EXPLANATION OF PLATES

### Plate I

Fig. 1—*Notiphila virgata.* Head in profile. ×40.
Fig. 2—*Notiphila virgata.* Middle femur and tibia. ×40.
Fig. 3—*Notiphila virgata.* Wing. ×30.
Fig. 4—*Notiphila macrochaeta.* Hind tibia and base of tarsi. ×40.
Fig. 5—*Notiphila bispinosa.* Apical segment of abdomen. ×40.
Fig. 6—*Notiphila furcata.* Apical segment of abdomen. ×40.

### Plate II

Fig. 7—*Dichaeta caudata.* Head in profile. ×40.
Fig. 8—*Dichaeta caudata.* Middle tibia. ×40.
Fig. 9—*Dichaeta caudata.* Wing. ×30.
Fig. 10—*Dichaeta caudata.* Apical segment of abdomen. ×40.
Fig. 11—*Dichaeta caudata.* (var. ? *brevicauda* Loew.) Apical segment of abdomen. ×40.

# SHORT STUDIES IN THE MALACHIIDAE (COLEOPTERA)

BY H. C. FALL

The types of all new species described in the following pages are males, and, unless otherwise stated, all are in the collection of the writer.

## TANAOPS LeConte

This genus was established by LeConte, in 1859, for two California species—*abdominalis* and *longiceps*—the latter having been described seven years previously as a *Malachius*. Both LeConte, at this time, and Horn, in his later Synopsis of the Malachiidae (1872), note certain epistomal and ventral differences in these two species, but a careful examination of the types, together with the more extensive material in my own cabinet, convinces me that the supposed differences are wholly non-existent. The epistomal structure in *abdominalis* and *longiceps* is virtually identical, being seemingly membranous in front, becoming corneous posteriorly; while the ventral pits or impressions in the males do not differ appreciably in the two species. Moreover these characters are practically constant in all the new species to be herein described.

The two most important generic characters of *Tanaops* are sexual in nature. In the male the basal two joints of the front tarsi are a little enlarged, the second produced a short distance over the third, but not lobed as in *Attalus;* while the fourth and fifth ventrals are bifoveate. The sixth segment is also impressed and emarginate but the structure is frequently not clearly visible. The pits or excavations of the fourth and fifth segments are more or less transverse and subcontiguous on the median line, and in one species—*coelestinus*—they coalesce into a single large pit on each of these segments. None of our true *Attalus* already described have the male ventral pits, but one or two undescribed species in my collection, which by the lobed second joint of the male front tarsi must be referred to *Attalus*, show also the male ventral pits in a somewhat modified form. The very elongate head in the two species known to LeConte was

regarded by him as a good generic character, but this gradually fails in the larger number of species now known. Throughout the genus there is a considerable degree of uniformity in many structural and color characters, which will accordingly receive scant attention in the short descriptions which follow. The margins of the ventral segments, and also the median line anteriorly, is always membranous and pale in color; the color, as given in the descriptions, should be understood as applying only to the corneous portions of the abdomen. Length is measured from the anterior margin of the prothorax to the tips of the elytra.

*Table of Species*

Antennae more strongly serrate, the outer edge of the intermediate joints more or less sinuate in the male.

Side margins of elytra pale throughout.

Abdomen (♀) red, last segment black, (♂) black; head extremely elongate ..... **angusticeps**

Abdomen red (except last segment) in both sexes; head somewhat less elongate.

Prothorax entirely or in great part red, elytra red with black vitta, sometimes interrupted at middle, sometimes broad, leaving the suture—except at base—tip and side margins narrowly red; antennae longer and more strongly serrate..... **abdominalis**

Prothorax black, elytra red with black scutellar spot; antennae shorter and less strongly serrate..... **ignitus**

Side margins of elytra not pale, the apical pale margin sometimes confined to the tip, sometimes extending forward along the suture.

Elytra finely, not very sparsely punctate, surface rather dull; antennae slender, the joints more elongate than in any other known species. **antennatus**

Elytra finely, very sparsely punctate, strongly shining, antennae less slender ..... **longiceps**

Antennae less strongly serrate, the outer edge of the intermediate joints straight or virtually so.

Front coxae spined in the male, abdomen yellow (♂) or black (♀). **spinifer**

Front coxae of male without spine.

Head more or less conspicuously elongate, much narrower than the thorax; elytra black, the tips alone paler, the pale color not or but slightly extending forward along the suture.

Head and prothorax more strongly elongate, the latter not distinctly wider than long (at least in the male), sides less rounded, entirely black ..... **terminalis**

Head and prothorax less elongate, the latter with more strongly rounded sides, red with median black space..... **dubitans**

Head not conspicuously elongate, elytra entirely blue or greenish, without pale tips.

Ventral segments entirely reddish yellow—at least in the male. **mimus**

Ventral segments in great part black in both sexes.
Prothorax less transverse, sides less strongly rounded, color normally black with a small reddish spot at the hind angles, rarely entirely black or with the sides entirely red; fourth and fifth ventrals of male with a single deep fovea on each ..... **coelestinus**
Prothorax more transverse, sides strongly rounded, color entirely red; fourth and fifth ventrals of the male conspicuously impressed anterior to the usual foveae..... **complex**
Head nearly as wide as the thorax, elytra red with common scutellar spot and subapical spot on each, black..... **repens**

**Tanaops angusticeps** new species

Moderately elongate, elytra widened behind; black, elytra faintly greenish, the side margins, apex and suture behind the middle reddish yellow. Head very elongate, the width behind the eyes scarcely or but little greater than half the width of the thorax; black, epistoma anteriorly testaceous, subimpunctate, shining. Antennae black, basal two or three joints pale beneath, much longer and distinctly serrate in the male, joints five to ten with the outer or oblique edge sinuate; in the female scarcely serrate, the oblique edges of the joints not sinuate. Prothorax entirely black, polished and subimpunctate, a little wider than long, sides feebly arcuate, subparallel or slightly divergent posteriorly, angles all rounded. Elytra less shining, surface slightly uneven, finely not closely punctulate. Body beneath largely black in the male, the abdomen in the female yellow with the last segment, and occasionally the preceding in part, black. Legs black, tibiae and tarsi sometimes brownish, trochanters often more or less pale. Length 3 to 4 mm.

California: Yosemite, June and July, three males, four females.

In this species the head is more narrowly elongate than in any other known to me. The male seems to fit very closely the description of Motschulsky's *Cephalistes apicalis*, which Horn has placed as a synonym of LeConte's *longiceps*. Without actual comparison of types it is now impossible to say just what *apicalis* is; for the present therefore it is best to accept the synonymy as stated by Horn.

**Tanaops abdominalis** LeConte, Proc. Acad. Nat. Sci. Phila., 1859, p. 74.

Rufo-testaceous, head in great part black, prothorax with or without a median black vitta; elytra each with a broad black or greenish black vitta, often narrowed or interrupted at middle, the side margins, tip and suture nearly to the base, pale; surface rather strongly shining throughout. Head less elongate than in the preceding species, fully three-fourths as wide behind the eyes as the prothorax, black with the epistoma more or less pale, the pale color sometimes extending on the front. Antennae black, more or less pale at base, distinctly stouter than in *angusticeps*, longer and more serrate in the male as usual. Prothorax somewhat wider than long, highly polished, subimpunctate, slightly narrowed in front, typically with a wide, black, median stripe,

which is more often entirely lacking. Elytra nearly as shining as the prothorax, finely, sparsely punctate, the surface as usual a little uneven. Body beneath rufo-testaceous except the metasternum, and in the female the last ventral segment. Legs black, often more or less pale at base. Length 3 to 3.5 mm.

California. Type from Ft. Tejon. The series before me includes five males and five females from Pomona and Pasadena. A common species in Southern California.

**Tanaops ignitus** new species

Head and prothorax black, elytra red with black scutellar spot, sterna black, abdomen entirely red in the male, the last segment black in the female. Head about two-thirds as wide as the thorax in the male, somewhat narrower in the female. Antennae moderately serrate in the male, distinctly shorter and less stout than in *abdominalis;* in the female scarcely serrate and scarcely reaching the base of the thorax when the head is extended. Thorax varying from distinctly wider than long to about as wide as long, sides rather feebly curved. Legs black, with the trochanters more or less pale, the tibiae and tarsi sometimes brownish. Length 2.6 to 3 mm.

California: Raymond, May, (Fenyes). Oregon: Huntington, (Wickham).

In the typical series from Raymond, California, the thorax is entirely black. In the single Oregon specimen—a male—the sides and base are narrowly pale, and the pale areas throughout are yellow rather than red. This species is unique in its coloration.

**Tanaops antennatus** new species

Head black, epistoma pale; thorax red with median black stripe, elytra black with greenish luster, tips and suture to middle red; below reddish yellow, sides of metasternum black, fourth and fifth ventrals dusky; legs black, trochanters and base of front femora pale. Head (♂) three-fourths as wide as the thorax. Antennae serrate, the joints unusually elongate, joints seven to nine twice as long as wide, tenth more than twice as long as wide. Thorax evidently wider than long, slightly wider behind, sides moderately arcuate. Elytra not very shining, finely, rather closely punctulate and sparsely, minutely sub-tuberculate; pale prostrate pubescence rather conspicuous. Length 2.8 mm.

Southern California: A single male specimen from Mt. Lowe.

The very elongate antennal joints constitute the chief distinguishing character of this species.

**Tanaops longiceps** LeConte, Proc. Acad. Nat. Sci. Phila., 1852, p. 165.

Black, strongly shining, thorax with the sides broadly pale in the type, more often entirely black or with the hind angles alone pale. Elytra with the apex

rufous, the suture sometimes pale in apical half. Head behind the eyes in the male three-fourths as wide as the thorax. Antennae moderately strongly serrate in the male. Thorax a little transverse, sides feebly arcuate at middle, scarcely widened basally. Elytra minutely, sparsely punctulate, the decumbent pubescence thin. Body beneath black, the margins and membranous median portions of the ventral segments pale as usual. Length 3 mm.

California: San Diego (type); La Jolla; Laguna Beach.

A specimen before me from La Jolla (near San Diego) is precisely like some examples in the type series at Cambridge. The epistomal and ventral differences between this species and *abdominalis* recorded by LeConte and Horn, have no basis in fact and must have been due to inaccurate observation.

**Tanaops spinifer** new species

Black, elytra with greenish luster, epistoma and under side of the basal three joints of the antennae pale, as usual; thorax with sides more or less pale, typically and commonly with the hind angles alone paler, quite as often entirely black; elytra with the tips narrowly pale, the pale color sometimes extending forward along the suture. Head behind the eyes about three-fifths as wide as the thorax in the female, a little wider in the male. Antennae moderately serrate in the male, much shorter and feebly so in the female. Thorax slightly wider than long, sides rather straight, surface polished and subimpunctate. Elytra less shining, surface a little uneven, pale recumbent pubescence distinct, punctuation sparse and fine. Body beneath black in the female, the abdomen pale in the male, with sides of first two ventrals blackish. Legs black, with trochanters and often base of front femora, pale. Front trochanters of male with an acute spine. Length 3 to 3.5 mm.

Arizona: "S. Arizona, Aug.," and "Oak Creek, 6000 ft. Aug.," (Snow); Williams, (Fenyes).

Two males and six females are before me. The type is a male labeled simply "Ariz. Aug." It is I believe from Southern Arizona. At once distinguishable from all other species known to us by the spined front trochanters of the male.

**Tanaops terminalis** new species

Black, the elytra with greenish luster, strongly shining throughout, elytral tips narrowly red, abdomen black in both sexes. Head elongate, about three-fifths as wide behind the eyes as the thorax in the female, a little wider in the male. Antennae moderately serrate in the male, not serrate in the female. Thorax slightly to scarcely wider than long, slightly but obviously widened behind, subimpunctate. Elytra sparsely, finely punctulate. Length 3.2 to 3.5 mm.

California: Lake Tahoe and Truckee, one male and four females.

The type is a male taken at Truckee by Wickham. The females were all taken by the writer at Lake Tahoe. In none of the specimens does the red color of the elytral tips show any tendency to extend forward along the suture.

**Tanaops dubitans** new species

Very similar to the last. The head seems to be a little less elongate and the thorax is obviously more transverse, and is broadly red at sides. The abdomen is more reddish at base, the basal segment being entirely red in the male, and blackish at sides only in the female; second segment dusky at sides in the male. It is possible these differences may disappear in a larger series.

California: Sylvania, Sonoma County. One pair sent me many years ago as *longiceps* by Mr. Ricksecker.

**Tanaops mimus** new species

Moderately elongate, shining, finely, rather sparsely pale pubescent and nigro-setose, finely, sparsely punctulate throughout. Head black, mouth pale; thorax rufo-testaceous with variable and irregular discal blackish cloud, which may be entirely wanting. Elytra entirely dark greenish bronze. Body beneath and legs, black, abdomen entirely yellow in the male, in the female yellow with terminal segment black, or varied with black throughout. Antennae black, pale at base, fully half as long as the body and narrowly serrate in the male, with all joints elongate, the outer ones twice as long as wide; a little shorter and less serrate in the female. Head about as long as wide, a little narrower than the thorax, the latter a little wider than long, the sides broadly arcuate, nearly straight and parallel at middle. Elytra gradually widened behind, surface with little irregularities which give the appearance of being finely tuberculate. Length 2.5 to 3 mm.

Utah: Nephi (type ♂), collected by Wickham. Colorado: Glenwood Springs, (Fenyes).

Very similar in appearance to *Attalus nigripes* Horn, which name had been attached to my specimens. The latter is, however, entirely black beneath and is supposedly a true *Attalus*.

**Tanaops coelestinus** Gorham, Biol. Centr.-Amer., Coleopt., iii, 2, p. 320, (1886).

Black, moderately shining, elytra with distinct bluish or greenish luster, thorax typically with a reddish spot at the hind angles, often entirely black, more rarely with sides red. Head moderately wide. Antennae not strongly serrate in the male, feebly so in the female. Thorax a little wider than long, not widened behind, sides rather straight. Elytra with the usual vestiture, sparsely, finely punctulate and minutely, sparsely tuberculate. Abdomen black in the female; in the male the fourth and fifth segments are predominantly yellow, the fourth more or less blackish at sides. Legs black, front and middle trochanters pale, front thighs sometimes pale beneath. Length 2.75 to 3 mm.

Arizona: Williams; Santa Rita Mountains; Chiricahua Mountains. Northern Mexico.

This species differs from all others known to me in the complete coalescence of the ventral pits of the fourth and fifth segments in the male. In all other species, the two foveae on each of the two segments mentioned are more or less completely separated by the membranous or semi-membranous median portion of the segment, which is frequently elevated in a cariniform manner in the dried specimens. In *coelestinus* there is a single transverse polished corneous fovea on each of these segments.

Mr. Champion in his recent Revision of the Mexican and Central American Malachiidae, retains this species in *Attalus*, but does not fail to note that the second joint of the anterior male tarsus of this species, and also of *A. mexicanus*, is not lobed, and remarks that they must come close to *Tanaops*. He seems, however, not to have noticed the ventral foveae of the male, a character pointing with considerable certainty to *Tanaops*. Champion mentions having seen one specimen of *coelestinus* with entirely red thorax.

**Tanaops complex** new species

Head black, margin of epistoma pale, prothorax entirely red, elytra blue green; body beneath black, the fourth ventral in the male red, with median black foveae; upper surface shining, the elytra less so because of the rather plentiful, pale, recumbent pubescence. Head not conspicuously elongate. Antennae moderately stout and serrate in the male, shorter, narrower and scarcely serrate in the female as usual. Prothorax distinctly transverse, sides strongly rounded, surface sparsely, minutely punctulate. Elytra finely, minutely punctulate and sub-tuberculate. Legs black, the trochanters and front thighs more or less pale, especially in the male. Fourth and fifth ventrals of male with the usual median foveae near the hind margins small and dull, and anterior to these on each segment two larger, shining, rather deep impressions, which are confluent at middle. Length 3 to 3.25 mm.

Arizona: Santa Rita Mountains, 8000 feet. A single pair communicated by the late Prof. Snow.

**Tanaops repens** new species

Red, strongly shining, posterior half of head, black, a common basal spot and an elongate subapical spot on each elytron greenish black; antennae, sides of metasternum, legs in part, the sixth ventral and sides of the fifth, black. Head about four-fifths as wide as the thorax, numerously, finely punctulate.

Antennae (♂) long and stout, moderately serrate, basal three joints pale beneath. Prothorax transversely, broadly oval, minutely, very sparsely punctulate. Elytra (♂) but little widened behind, finely punctulate and with the usual vestiture. Body beneath pale red, the legs black, the trochanters and base of front and middle femora pale, tarsi and tips of tibiae brownish. Length, 3.25 mm.

California: Havilah. A single male collected by G. R. Pilate.

This species strongly resembles in color certain specimens of *abdominalis*, but is at once separable, by the tabular characters. It is also very similar in color to several species of *Attalus*.

### MICROLIPUS LeConte

The genus *Microlipus* contains a few slender *Malachius*-like species of Coleoptera, which are, with a single exception, members of the extreme West Coast fauna. They are not overly abundant in collections and there are few references to them in the books. A critical examination of the material in my own cabinet and that of Dr. Fenyes reveals the presence of three apparently distinct forms allied to *laticeps*, and with the description of these it has been thought well to present a synoptic table, together with brief references to all the known species, followed by some observations concerning the standing of the genus itself.

*Table of Species*

Elytra not appendiculate in the male, both sexes winged; pronotum as viewed in profile not conspicuously reflexo-explanate posteriorly, and scarcely more so than in front.

Antennae pectinate in the male..... **prolixicornis**

Antennae not pectinate in the male.

Prothorax smooth and shining, distinctly wider than long.... **laevicollis**

Prothorax punctulate and more or less finely alutaceous, less shining.

Antennae of male as long as the entire body, dorsal cloud of pronotum small or obsolescent..... **productus**

Antennae of male much shorter, one-half to three-fourths the length of the body, pronotum with broad dorsal dark stripe or with the margins alone narrowly pale.

Prothorax, at least in the male, as long as wide or very nearly so, pale margins narrow.

Elytra distinctly inflated posteriorly in the female; head, including the eyes, scarcely wider in the male than the prothorax, pale side margins of the latter very narrow, sometimes merely vestigial. **franciscanus**

Elytra not or only very slightly inflated posteriorly in the female; head in the male evidently wider than the prothorax, the pale lateral margins of the latter better developed, especially at the front angles ..... **laticeps**

Prothorax distinctly wider than long in both sexes, sides broadly pale ..... **aequalis**

Elytra appendiculate in the male, the appendix more or less testaceous in color; females apterous; the elytra strongly inflated posteriorly, unicolorous; pronotum as viewed in profile rather strongly, broadly reflexo-explanate posteriorly.

Pronotum with sides broadly rufo-testaceous, apical half of tibiae and base of tarsi testaceous—at least in the male..... **longicollis**

Pronotum with hind angles only narrowly pale, legs dark throughout. **moerens**

**Microlipus prolixicornis** Fall (*Malachius*). Oec. Pap. Cal. Acad. Sci., viii, 1901, p. 246.

This species is conspicuously distinct from all others of the genus by its strongly pectinate male antennae, which are fully as long as the entire body. In the female the antennae are moderately serrate and scarcely attain the middle of the elytra. The form is slender, color piceous bronzed, thorax with yellow margins of variable width. Thorax sinuately narrowed behind, all the angles rounded. Elytra not appendiculate, but with yellow tips in both sexes. Length 3.3 to 3.6. mm.

California: Pasadena.

**Microlipus laevicollis** Horn, Trans. Am. Ent. Soc., iv, 1872, p. 116.

This species is unknown to me in nature. It was described by Horn from a unique male specimen from Nebraska in the Ulke collection, and I do not know if it has been duplicated. It may be known from all our other species by the smooth and shining head and prothorax, the latter—according to Horn—proportionately broader than in any other species known to him. The entire lack of testaceous margin to the prothorax seems also to be a unique character among the species with non-appendiculate elytra. *Laevicollis* is the only species of the genus known from the interior of the continent, all others being confined to the true Pacific Coast fauna: an interesting condition which is exactly paralleled in the very closely related (if really generically distinct) *Malachius*, all the native species of which are members of the Pacific Coast fauna, with the single exception of *ulkei*, described from Dakota.

**Microlipus productus** new species

Form elongate, parallel in the male, elytra gradually a little widened posteriorly in the female; aeneo-piceous, mouth and sides of front below the antennae, the basal two joints of the latter in part, the prothorax except for a variably developed dorsal cloud, elytral tips, coxae, trochanters, and hind margins of ventral segments, rufo-testaceous; tibiae and tarsi piceo-testaceous in some examples, scarcely paler in others. Head (♂) slightly wider than the prothorax, front with a moderately deep, transverse impression, surface very finely alutaceous and sparsely, minutely punctate. Antennae (♂) as long as the entire body or very nearly so, joints four to eleven four to five times as long as wide, the intermediate ones dilated apically and forming a well marked subacute apical angle, giving a subserrate appearance. In the female the antennae are scarcely two-thirds as long as the body, the intermediate joints more gradually dilated apically, with obtuse angles. Prothorax as long as wide, just perceptibly narrowed posteriorly, surface more distinctly alutaceous than the head, punctuation similarly fine and sparse, color in great part yellow (entirely so in the single female at hand), the dorsal stripe small and imperfect, attaining neither base nor apex. Elytra slightly wider at base than the prothorax, very little dilated apically in the male, and but little more so in the female; surface finely subrugulose, finely, indistinctly punctate, tips narrowly rufous in both sexes. Body beneath and legs as usual in the genus. Length 3.5 to 3.8 mm.

Southern California. Described from five males and four females taken in the mountains above Claremont, (Baker), at Pasadena and Sierra Madre, (Fenyes), and on Mt. Wilson, June 14, by myself. The type is a Claremont male.

**Microlipus franciscanus** new species

Form slender, nearly parallel in the male, the elytra gradually widened to apex in the female. Head and prothorax distinctly alutaceous and feebly shining, greenish black, elytra aeneo-piceous and dull in the male, greenish black and distinctly shining in the female. Prothorax with very narrow testaceous side margins, which are usually slightly widened at the base angles and continued very narrowly around the basal edge. Mouth, under side of the basal four or five joints of the antennae, tips of elytra in both sexes, the coxae and trochanters (especially in the male), rufo-testaceous. Head across the eyes scarcely wider than the prothorax. Antennae not serrate, a little longer than half the body in the male, and less than half as long as the body in the female; joints five to ten from two to three times as long as wide, the outer ones gradually more slender. Prothorax barely as long as wide, feebly but perceptibly narrowed posteriorly. Elytra finely subrugulose and dull in the male, distinctly smoother and more shining in the female. Body beneath and legs as usual, the tibiae and tarsi more or less paler, rufo-piceous. Length 3 to 3.8 mm.

Middle California Coast region.

The series before me consists of two males and ten females from Berkeley (type ♂), Belmont, Monterey, Point Reyes, Pacific Grove and Lagunitas.

This species is closely related to *laticeps* and doubtless so stands in collections. To the characters given in the table for their distinction there may be added—antennae subserrate in the male of *laticeps*, scarcely at all so in *franciscanus;* legs largely pale in male *laticeps*, almost entirely dark in *franciscanus;* the pale margin of the prothorax, though narrow, is as a rule wider in *laticeps* and is entire, while in *franciscanus* it completely or virtually disappears for a greater or less distance along the front margin, and in several examples exists only along the extreme edge about the basal angles. In the second male of my series (Monterey) the pale color at the tips of the elytra is reduced almost to the vanishing point, while in a Monterey female in Dr. Fenyes' collection and in my single male of *laticeps* it is entirely lost.

**Microlipus laticeps** LeConte, Proc. Acad. Nat. Sci. Phila., 1852, p. 168.

This species, the type of the genus *Microlipus* and the first to be made known, was described in 1852 from San Diego specimens. LeConte's description is not now accessible to me, but Horn in his Synopsis of the Malachiidae in 1872 remarks that all known specimens are males. This, however, is not true, the specimen on the name label—evidently one of the original series—being a female. I have almost exactly similar females from San Diego, and with them associate without hesitation a male from Long Beach, about ninety miles farther up the coast. This species, I suspect, is confined to the Southern California Coast region, being replaced by the closely allied but apparently distinct *franciscanus* in the Middle Coast region. For differences observed between these two, in addition to those of the table, see remarks under *franciscanus.*

**Microlipus aequalis** new species

Aeneo-piceous, prothorax rufo-testaceous with broad median piceous stripe, which does not quite reach either the basal or apical margins; legs largely pale in color, the apical half of the femora piceous, the tibiae dusky; mouth and tips of elytra pale. Antennae fully two-thirds as long as the body in the male, not appreciably serrate, rather less than half as long as the body in the female, piceous with the underside of basal four joints pale in both sexes. Head not appreciably wider than the prothorax in the male, the latter wider than long

and evenly rounded at sides in both sexes. Elytra nearly parallel, slightly wider than the prothorax. Sculpture and pubescence as usual. Length 2.9 to 3.2 mm.

A single pair beaten from live oak at Pasadena, California, in April.

If the characters embodied in these two specimens prove constant, the species is peculiar in that aside from the difference in the length of the antennae, there are no appreciable sexual differences either in color or bodily form. The general appearance is strikingly like that of the female of *laticeps*, except for the darker prothorax of the latter.

**Microlipus longicollis** Motschulsky, Bull. Soc. Imp. Nat. Mosc., 1859, p. 405.

On comparison some years ago, a male specimen from Pasadena, California, seemed identical with an example of this species in the LeConte collection sent by Motschulsky. Horn says, "thorax longer than wide"; Motschulsky used the expression "thorace subelongato." I did not take measurements of the LeConte example, but in the series at hand the length of the thorax varies from a trifle less to slightly greater than the width, the variation being quite independent of sex. This species is rather closely related to the next, but may probably be separated with certainty by the broadly rufous sides of the prothorax. The elytra vary in color from aeneo-piceous to bluish or greenish. The series at hand consists of four males and twelve females, all collected by Dr. Fenyes in California, and bearing locality labels—Santa Monica, Redondo, Catalina Island, Pasadena and Sugar Pine (Yosemite region). Motschulsky's type was said to be from "Nova Helvetia," a locality which I am at present unable to interpret, but Horn gives simply California.

**Microlipus moerens** LeConte, Proc. Acad. Sci. Phila., 1859, p. 283.

This species and the preceding—as indicated in the table—are readily separated from all others by the elytra being appendiculate in the male, and not tipped with yellow in the female.

The color in the present species is greenish black with the margins of the prothorax very narrowly rufous at the hind angles only. In one example from Sonoma County, California, the pale color at the hind angles of the prothorax is wanting, the specimen agreeing throughout with the description of Motschulsky's *uniformis*, which I have no doubt belongs here, rather than

with *laticeps* as was suggested by Horn. Both LeConte's and Motschulsky's papers bear the date 1859, and I have no means of ascertaining which appeared first, *moerens*, however, takes page precedence over *uniformis*. In the three males and four females before me the prothorax varies from as wide as long to a little longer than wide. As a rule it averages somewhat narrower than in *longicollis*, a condition which is just the reverse of the statements made in Horn's table, but doubtless specimens of *moerens* will occur with the width a little in excess of the length, just as in *longicollis*.

*Moerens* was described from Point Reyes, about thirty miles north of San Francisco. Most of the examples at hand were collected by Dr. Fenyes at Pacific Grove, a somewhat greater distance south of San Francisco. The Sonoma specimen was collected by Ricksecker.

The characters given for the generic separation of the Malachiini in the LeConte and Horn Classification (1883) are precisely those given by Horn in his Synopsis of eleven years before. *Malachius* and *Microlipus* are here separated as follows.

Antennae inserted on the front nearly between the eyes. . . . **Malachius**
Antennae inserted at anterior edge of front near the sides. . **Microlipus**

This sounds like an important and satisfactory distinction, but investigation proves it to be very far from such, at least so far as our representatives of the two genera are concerned. In all cases the antennae are inserted near the anterior margin of the front, their distance apart being rather more than twice their distance from the eyes, the thickened edge of the antennal pits contiguous to the epistomal suture. It is possible that the antennae are more frontal in position in the European species of *Malachius* than in ours, in fact in *M. aeneus*, our only introduced species, they do appear to be a trifle more removed from the frontal margin, but this seems due rather to a greater thickening of the raised edge of the antennal pits than to any real difference in position. Following the descriptions of the four known species of *Microlipus*, Horn states further that this genus resembles *Malachius* in form and general aspect, but the species are more slender, the legs longer and the antennae are scarcely serrate, and adds that the sexual characters serve as a means of readily separating *Microlipus* from all the other genera of the tribe in our

fauna. Taking these points up seriatim—it is true that the form is more slender in *Microlipus* than in any of the species of *Malachius* known to Horn at the time of writing, but several quite as slender species of *Malachius* have since been described. I am unable to discover any difference of moment in the length of the legs. The antennal formation varies much in *Malachius*, and while usually distinctly serrate or even pectinate in the males, in one species—*pristinus*—which in general make-up is a good *Malachius*, the antennae are very feebly serrate, even less so than in the new *Microlipus productus*. On the other hand *prolixicornis*, which agrees in narrow form and notably in the peculiar posteriorly narrowed thorax existing in several (not all) species of *Microlipus*, has strongly pectinate male antennae and was for this reason originally described by me as a *Malachius*. As to sexual characters, Horn mentions elytra both appendiculate and not in the male, which is quite as true of *Malachius;* "front tarsi of male stouter than in the female" in *Microlipus*, which is not really true; and "elytra apterous in the females," which is true of the two species of which females were recognized by Horn but is not true of the other two, one of which—*laticeps*—is the type of the genus. Other male characters, such as the longer, stouter, more pilose antennae, the generally more parallel form, certain differences in color, and the deeply fissured last ventral are also more or less common to the two genera. No species of *Malachius*, so far as I am aware, has apterous females, and this character together with the completely non-serrate antennae, which are somewhat thicker in the male but not otherwise sexually modified, together with the somewhat peculiar form of the prothorax, which is also independent of sex, may perhaps serve to separate *moerens* and *longicollis* generically from the other species now recorded under *Microlipus*, all of which seem referable to *Malachius* as we now understand it. In this connection it is proper to say that presence or absence of wings is not generally held to be in itself a generic character, an instance of which is not far to seek in the nearby genus *Collops*. If, however, it should seem best to separate *moerens* and *longicollis* on the characters above mentioned, a new name would have to be proposed, the type of *Microlipus* being as above remarked not separable from *Malachius*. I am not prepared at the present time to carry out this

suggestion, but content myself with presenting the facts as I now see them, pending a fuller knowledge of the European species of *Malachius* and allied genera.

**ATTALUS** Erichson

The nondescript forms in this genus in our collections are very numerous, and a complete revision is much to be desired. This should not be so very difficult to one who has accumulated the necessary material, but there may be some puzzling relationships to solve—especially in the vicinity of *rufomarginatus* and *lecontei* (*basalis* LeConte). At the risk of further complicating matters the following descriptions of twelve of the new species in my own cabinet are presented. They seem to be abundantly distinct from any of our previously described forms, nor am I able to identify any of them by Mr. Champion's recent paper on the Mexican and Central American species. I am not yet prepared to give a revised table of *Attalus*, but the new species here made known may be separated among themselves as follows.

*Table of Species*

1. Elytra entirely black ..... 3
   Elytra not entirely black ..... 2
2. Elytra rufo-testaceous, each with subapical and sometimes basal spot, black. **serraticornis**
   Elytra black in apical half, basal half yellow ..... **dimidiatus**
   Elytra black with tips red; head and thorax red ..... **semirubidus**
   Elytra black with side margins, tips, and suture (except basally) rufo-testaceous ..... **demissus**
   Elytra black with side margins and suture very narrowly and indefinitely paler—tips not pale ..... **dilutimargo**
   Elytra black with very narrow yellow lateral and apical margins, head tuberculate ..... **tuberculifrons**
3. Head and thorax rufo-testaceous ..... **atripennis**
   Head, at least, and generally the thorax largely black ..... 4
4. Upper surface nearly glabrous ..... **glabrellus**
   Upper surface distinctly pubescent ..... 5
5. Last dorsal segment of the abdomen notched at tip, male with ventral foveae ..... 6
   Last dorsal segment not notched, male without ventral foveae ..... 7
6. Antennae (♂) narrowly serrate, fifth ventral of male foveate . . **rusticus**
   Antennae (♂) not serrate, fourth and fifth ventrals foveate . . **foveiventris**
7. Pubescence sparser, punctuation less close, elytra not tuberculate . . . **futilis**
   Pubescence denser, punctuation closer, elytra finely subtuberculate. **grisellus**

**Attalus serraticornis** new species

Rather stout, very little widened posteriorly in either sex; pale red, the head varying from entirely red to black with the mouth red; prothorax with or without a median black stripe, elytra each with a small, black basal spot not reaching the suture, and a subapical one attaining the side margin but not the suture, the basal spots sometimes lacking. Head and thorax moderately shining, elytra dull, pale pubescence very fine and short, the few erect black hairs on the elytra very short and inconspicuous. Head subequal to the thorax in width, the latter transversely oval, both very minutely, sparsely punctulate. Antennae black, more or less pale at base, strongly serrate and setose in the male, joints three to six as wide as long; in the female shorter and narrower, but distinctly serrate, joints four to ten as wide as long. Elytra finely and feebly, but rather closely, punctate. Metasternum black, ventral segments black in the male, red in the female, the membranous margins of the segments pale—as usual. In the type the terminal segment is pale, but in a second male is black. Legs red, the hind thighs dusky at tip. Length 2.5 mm.

Southern California: Palm Springs and Old Beach on the border of the Colorado Desert, April, (Fenyes): New Mexico; Alamogordo: Texas—without specific locality. The type is a male from Palm Springs, California.

The antennae are more strongly serrate than in any other of our species of *Attalus*. In the male the tip of the pygidium is broadly rounded, in the female narrower and subtruncate. The last ventral of the male is in all examples unusually and widely exposed and is more deeply, roundly emarginate and impressed than usual.

**Attalus dimidiatus** new species

Moderately elongate, widened posteriorly, head and thorax strongly shining, elytra moderately so. Head (♂) rufous anteriorly, vertex and occiput black; thorax rufous with black median stripe, elytra yellow in basal half, apical half black; metasternum and abdomen black, legs red, hind thighs dusky. Head as wide as the thorax, the latter suboval, wider than long, both polished and subimpunctate. Antennae black, pale at base, narrowly serrate, all the joints longer than wide, the outer ones nearly or quite twice as long as wide. Elytra impunctate or very nearly so. Length 1.9 to 2.2 mm.

Southern California: Old Beach (Colorado Desert); one pair collected by Dr. Fenyes.

The type described above is the male; the female differs in having the head, thorax and legs entirely rufous, the antennae a little shorter and scarcely serrate; head and thorax wider, the eyes relatively smaller, the pygidium more broadly rounded at

tip. There is scarcely a sign of pubescence—except for the few scattered very short, erect, black hairs, and from the fact that the integuments are virtually impunctate, I judge this is the natural condition. The color of the elytra—half black, half yellow—is quite different from any of our other species.

**Attalus semirubidus** new species

Form moderate, upper surface shining, head and thorax red, the former with occiput black, elytra greenish black, apices narrowly red. Antennae feebly serrate in the male, joints two to six as wide as long, seven to ten becoming just perceptibly longer than wide. Head wider than long, but little narrower than the thorax, the latter transverse, rather strongly rounded at sides, base broadly rounded, apex straighter, both head and thorax minutely, feebly, sparsely punctulate. Elytra rather coarsely punctate and with numerous rather long, semi-erect, black setae, the recumbent pubescence very fine, short and sparse. Body beneath red, the metasternum black; legs red, the front and middle tibiae and tarsi dusky, hind tibiae and tarsi blackish. Length 2.2 mm.

Alabama: Mobile (Loding).

The type and only specimen at hand is a male. The elytra are scarcely dilated apically; the apical red margin extends forward very narrowly and diffusely along the sides to about the middle. This species differs from all previously described in its color arrangement, but may for the present be placed near *melanopterus*.

**Attalus demissus** new species

Moderately elongate, head and thorax distinctly shining, elytra less shining, vestiture much as usual, the erect, black setae of the elytra of moderate length. Head black, epistoma pale; thorax entirely black or with the reflexed margin around the hind angles pallescent; elytra black, with the outer margins tip and suture (except at base) narrowly rufous. Body beneath and legs black. Antennae (♂) more than half the length of the body, feebly serrate, the intermediate joints twice as long as wide; (♀) shorter, joints one-half longer than wide. Head as long as, or slightly longer than wide, not much narrower than the thorax, the latter rather narrow, a little wider than long in the male, as long as wide in the female, sides parallel and feebly arcuate, surface minutely and sparsely punctate. Elytra a little wider behind in the male, more dilated apically in the female, surface feebly, finely punctate. Length 2.3 to 2.5 mm.

Colorado: Glenwood Springs, July, (Fenyes).

A single pair, of which the male is taken as the type. In the length of the head this species approaches *oregonensis*, and should probably stand between that species and those with broader

heads. The black abdomen and legs will separate it at once from the long-headed species already described, and the relatively narrow thorax and head, and more elongate male antennae will separate it from *difficilis*, to which it bears a general resemblance.

**Attalus dilutimargo** new species

Shining, black, elytra pubescent, mouth pale, the narrow reflexed edge around the base of the thorax dull testaceous, and the lateral and sutural edges of the elytra narrowly, diffusely paler; pubescence fine, sparse and inconspicuous, the few erect setae also unusually fine and visible only in profile; punctuation throughout sparse and minute, indistinct upon the elytra. Antennae (♂) but little shorter than half the length of the body, not serrate, brownish piceous, basal joints indefinitely paler, joints three to eleven longer than wide, the outer ones more distinctly so. In the female the antennae scarcely pass the base of the thorax, joints scarcely longer than wide. Head as wide as the thorax, the latter transverse, sides moderately rounded. Elytra moderately widened behind in both sexes. Body beneath black; legs piceous, tibiae and tarsi—more especially of the four anterior feet—paler. Length 1.5 to 1.7 mm.

Arizona: Huachuca Mountains, May 3, (Mr. Clemence).

A single pair, of which the male is the type.

This very small species is apparently nearest to the California *lobulatus*, but the pale margins of the latter are broader and sharply defined, and on the elytra extend around the elytral apex.

**Attalus tuberculifrons** new species

Moderately elongate, feebly shining, black, head—except the occiput—and the entire limb of the thorax narrowly rufo-testaceous, side and apical margins of elytra very narrowly yellow. Antennae (♂) rather short, not serrate, rufo-testaceous, outer joints slightly darker, joints three to five a little stouter, following joints a little longer than wide. Head slightly wider than the thorax, front bi-impressed, the impressions separated by an elongate tuberculiform prominence; surface finely alutaceous and with minute scattered punctures. Thorax strongly transverse, surface similarly alutaceous and punctulate; the pale margin widened a little at the hind angles, extremely narrow along the apex, disk with faint greenish lustre. Elytra feebly widened apically, surface feebly rugulose and minutely, obsoletely punctulate. Body beneath black; front and middle legs rufo-testaceous, the upper sides of the femora black; hind legs black with tibiae and tarsi brownish. Length 2 mm.

Arizona: Santa Rita Mountains, April 13, a single male.

A small species of the general aspect of *basalis* LeConte, but less shining and with frontal tubercle. The pubescence is pale, semi-erect and moderately plentiful, though fine and inconspicuous, and without longer erect setae. The last joint of the maxillary palpi is less pointed than usual, the tip being rather widely truncate.

**Attalus atripennis** new species

Form short and broad, moderately shining, subimpunctate and subglabrous, the pubescence very sparse, fine short and suberect. Head, thorax, antennae and legs rufo-testaceous, the outer joints of the antennae dusky, coxae and base of hind thighs blackish; elytra, metasternum and abdomen, black. Antennae (♀) scarcely passing the base of the thorax, not serrate, joints a little longer than wide. Head wider than long, thorax strongly transverse, about one-half wider than long, elytra moderately widened apically. Length 2.5 mm.

Arizona: Santa Rita Mountains, (Snow).

The type and only specimen before me is a female. It is evidently allied to *melanopterus*, but the latter has the abdomen pale, the thorax less strongly transverse and the antennae a little stouter. In *melanopterus* the hind femora are pale at base and blackish apically.

**Attalus glabrellus** new species

Form rather stout, distinctly shining throughout, nearly glabrous and subimpunctate. Black, thorax typically with a rufous spot at the hind angles, varying to entirely black, or with the sides broadly rufous. Head broad, epistomal margin pale. Antennae (♂) scarcely half as long as the body, scarcely serrate, basal joints more or less pale, intermediate joints a little longer than wide. Thorax transverse, subtruncate in front, broadly rounded behind. Elytra gradually wider behind in the male, more strongly dilated posteriorly in the female, surface minutely subrugulose. Legs black, the front tibiae and tarsi more or less piceo-testaceous. Length 1.75 to 2.25 mm.

California: Pomona (type ♂), Pasadena, Claremont, Azusa, San Diego, Mount Wilson, San Bernardino Mountains, Kern County, Santa Clara County, Marin County.

An abundant species in Southern California. A form taken by the writer at Williams, Arizona, is very similar, but in this the pubescence and punctuation are not so nearly obsolete and the legs differ a little in color; quite likely no more than a geographical race. This species is quite closely allied to *lecontei* Champion (*basalis* LeConte), but I feel confident they are not identical. In the type of the latter the thorax is finely but distinctly, numerously punctate, the base margined with yellow, and the legs, except the hind femora in part, are pale; it was described from the desert region along the Colorado River.

**Attalus rusticus** new species

Moderately elongate, a little wider behind, brownish piceous to dull black, lateral and basal margins of thorax rufous. Head feebly shining, thorax more

evidently so, elytra opaque; fine, pale, recumbent pubescence quite evident, mostly transversely directed on the disk, erect setae rather short but distinct in profile. Head nearly as wide as the prothorax, black, epistoma more or less pale. Antennae in the male narrowly serrate, joints three to ten one-third to three-fourths longer than wide; in the female scarcely serrate, joints three to ten nearly equal in length and about one-half longer than wide. Thorax transverse, broadly oval, with the usual scattered minute punctures. Elytra at base slightly wider than the thorax, fully twice as long as wide, surface finely, feebly, rather closely punctulate and feebly subrugulose. Body beneath blackish, legs brownish piceous to black, femora indefinitely paler at base in some examples. Last dorsal segment of abdomen with a shallow notch at apex in both sexes; fifth ventral of male with a smooth, transversely oval fovea each side of the middle and near its posterior margin. Length 2.5 to 3 mm.

Southern Arizona. The type—a male, and one female were taken at Pearce, Cochise County, May 19, by Mr. V. L. Clemence.

With these I place, without hesitation, two female examples from the Dragoon Mountains and Santa Rita Mountains, also taken by Mr. Clemence. In the latter the thorax is entirely black, except for a small rufous spot at the hind angles, while in the Dragoon Mountains one it is yellow with a black discal spot. The notched apex of the last dorsal segment is an unusual character, still more pronounced in the following species, but not elsewhere noticed by me. The ventral foveae in this and the following species suggest a relationship with *Tanaops*, but the narrow elongate lobe of the second joint of the anterior male tarsi is typical of *Attalus*.

**Attalus foveiventris** new species

Black, elytra with greenish luster, thorax red with black discal space of variable size. Head and thorax distinctly shining, elytra only moderately so, vestiture as in the preceding, the black setae rather more conspicuous. Head nearly as wide as the thorax, black, epistoma in great part pale. Antennae black, not serrate, joints three to ten subparallel and nearly twice as long as wide in the male, in the female smaller and with the joints less elongate, but evidently longer than wide. Thorax transverse, sides rather strongly rounded, punctulate and pubescent as usual. Elytra slightly wider at base than the thorax, strongly dilated apically in both sexes, punctuation and vestiture nearly as in the preceding species. Body beneath black, the last three ventrals red in the male. Legs entirely black. Last dorsal segment of abdomen distinctly notched at tip in both sexes, rather deeply so in the male. Male with fourth and fifth ventral segments foveate each side of the middle. Length, 2.5 mm.

Arizona: Nogales. A single pair collected by Nunenmacher.

Somewhat similar in general aspect to the preceding, but with many points of difference, notably the non-serrate antennae, dilated elytra and ventral foveae.

**Attalus futilis** new species

Black with faint greenish luster, moderately shining, sparsely setose, and with rather plentiful, fine, pale pubescence. The epistoma, margin of thorax very narrowly at the hind angles, and the basal three joints of the antennae in part, are pale. Antennae (♂) scarcely serrate, attaining the elytral humeri, joints three to eleven evidently longer than wide. Head moderately broad but evidently narrower than the thorax, the latter transversely oval, elytra gradually, moderately dilated apically, upper surface throughout very finely, but distinctly and numerously punctate. Body beneath black, the last three ventral segments narrowly pale at sides in type, but not evidently so in other examples. Legs black. Length 1.6 to 2 mm.

New Mexico: Pecos, June to July, (Cockerell), three males, two females.

In one male the basal six joints of the antennae are pale beneath, as are the front and middle legs in great part. This small and inconspicuous species would fall near *morulus* in Horn's table; the latter is, however, much larger, less pubescent, less evidently punctate and with longer, stouter antennae.

**Attalus grisellus** new species

Very similar to the preceding, differing as follows. Pale pubescence more abundant, giving a grayish aspect, the punctuation also a little stronger and closer, the surface in consequence less shining. The pale spot at the hind angles of the thorax is larger, and the elytra have the appearance of being finely, sparsely subtuberculate, not at all so in *futilis*. Length 2 to 2.4 mm.

New Mexico: Alamogordo, April and May, (Viereck and Rehn). Type no. 8123, Acad. Nat. Sci. Phila.

It is possible that this species is no more than a variety or race of the preceding; the nine examples before me are, however, quite constant in showing the differences mentioned. The type, a male, is returned to the Academy of Nat. Sciences, Philadelphia; paratypes are in my own collection.

**Attalus rostratus** Horn

The unique type is a female, the head very elongate, the elytra opaque and subrugose, perhaps abnormally so. It is more than likely that the male will show this to be a *Tanaops*, in which case it may prove to be the *angusticeps* of the present paper, and this, as already stated, may really be the *apicalis* of Moschulsky.

**Attalus rufomarginatus** Motschulsky

Specimens in the LeConte collection bearing this label—in Horn's handwriting—are *Tanaops abdominalis*, as are examples in the writer's collection that were long ago identified as *rufomarginatus* by Horn. From Motschulsky's description there can be no doubt that *rufomarginatus* is a true *Attalus*, of which I have at least three species of the color type indicated by Motschulsky's figure; one of these is pretty sure to be the real thing.

**Attalus basalis** LeConte

According to Champion, the *Anthocomus basalis* of Erichson is an *Attalus*, and therefore LeConte's species requires a new name; he proposes to call it *lecontei*.[1]

**Attalus zebraicus** Blatchley

This is suspiciously close to *varians* Horn, but more specimens are needed to determine the relationship.

**Attalus parallelus** Horn

This cannot be separated from *rufiventris* Horn.

**MALACHIUS** Fabricius

**Malachius spinipennis** Horn

This name being preoccupied by Germar, for a European species, the name *hornii* is proposed in its stead.

[1] See Trans. Ent. Soc. London, 1914, p. 60.

# THE STANFORD EXPEDITION TO BRAZIL, 1911

J. C. BRANNER, DIRECTOR

## ORTHOPTERA II

BY JAMES A. G. REHN

For explanatory remarks regarding the collections here treated the student is referred to the prefatory notes in the first paper of this series,[1] which bears the subtitle "Dermaptera and Orthoptera I." This final portion of the study embraces the species belonging to the families Tettigoniidae and Gryllidae. As in the previous paper, certain records of material taken at Pará, State of Pará, by C. F. Baker, and at Peixe Boi, a short distance east of Pará, by H. B. Merrill, have also been included, but only where it was desirable to amplify comments on the Stanford Expedition representation. A few specimens from Porto Velho, Rio Madeira, belonging to Cornell University, have also been included to augment the representation from that locality, while certain other specimens from eastern Peruvian localities, belonging to the Academy, have been studied in connection with the Rio Madeira material, and are here reported.

In the present paper sixty-two species, belonging to forty genera, are treated, of which fifteen species and one genus are described as new. The total number of specimens reported in this paper is three hundred and sixteen.

### Tettigoniidae

#### Phaneropterinae

**Hyperophora branneri** new species (Plate III, figs. 1 and 2.)

A very striking species, having male cerci in general resembling those of *H. brasiliensis, cerviformis, major* and *gracilis*, but lacking the slender distal portion found in those species, while the whole distal portion of the same appendages of *branneri* is inflated or rather sub-bulbous. The general form is similar to that of *brasiliensis*, but the limbs are somewhat more robust and the pronotum is broader, with the lateral carinae more angulate.

[1] Trans. Am. Ent. Soc., xlii, pp. 215 to 308, pls. xiv and xv, (1916).

When compared with *H. minor* the new species is found to differ in numerous features other than the cercal form, while from *H. abrupta*, described beyond, *branneri* can be separated by the characters given under that species.

Type.—♂; Independencia, State of Parahyba, Brazil. (Stanford Expedition; Mann and Heath.) [Acad. Nat. Sci. Phila., Type no. 5294.]

Size medium: form considerably elongate. Head with the dorsal length about one-half that of the dorsum of the pronotum: occiput regularly and rather strongly declivent to the apex of the fastigium; the latter narrow, acuminate, subcompressed, sub-sulcate dorsad, apex almost touching the fastigium of the face, the latter being acute-angulate in form: eyes prominent, semiglobose in form when seen from the dorsum, very short-ovate in basal outline, their depth slightly more than one-half that of the infra-ocular portion of the genae: antennae elongate, fragile, proximal joint but little smaller than the eye. Pronotum moderately elongate, weakly sellate, the disk of the pronotum with its greatest caudal width equal to two-thirds of the greatest length; cephalic margin of disk moderately arcuato-emarginate, caudal margin of disk equally arcuate; lateral angles of disk distinct, sharp, weakly and regularly expanding caudad; transverse impression on disk in general form rectangulate: lateral lobes of pronotum with greatest depth contained one and two-thirds times in the length of the same; cephalic margin straight, ventro-cephalic angle obtuse-subrectangulate, ventral margin straight and weakly oblique on cephalic two-thirds, then strongly full arcuate over the caudal margin to the rectangulate humeral sinus. Tegmina surpassing the tips of the caudal femora, but falling considerably short of the wing tips, in form elongate-lanceolate, the apex narrowly rounded, the form very faintly tapering from the proximal fourth to the distal sixth: mediastine vein incomplete or lacking; discoidal vein with three regular rami to the sutural margin, these connected in the fashion usual in the genus: stridulating field elongate, relatively narrow, for venation see figure. Wing with distal portion subcoriaceous like the tegmina, acuminate, surpassing the tegmina by a distance equal to twice the length of the pronotal disk. Abdominal segments weakly carinate dorsad, the penultimate dorsal segment produced mesad into a rectangulate process which overhangs the supra-anal plate, the lateral margins of this process faintly concave and the median line weakly carinate, the form in section subtectate: disto-dorsal abdominal segment narrow, strongly transverse: supra-anal plate slightly acute trigonal, the margins thickened in a fashion increasing to the immediate apex, margins hirsute: cerci with the shaft moderately tapering, gently arcuate mesad and dorsad, hirsute; the apex developed on the internal face, which bears a moderately inflated process similar to that found mesad in the same region in *brasiliensis* and related species, this process bearing a sharp point, ending in a short decurved tooth, directed cephalad, while the distal extremity of the whole cercus is bluntly subtruncate with three low, sub-tuberculate bosses, the dorsal surface of the cercal process with usual sculpture of the species

of the genus: subgenital plate of medium length, narrowing distad, the apical margin rectangulate emarginate, the lateral angles produced, no styles present; the surface of the plate triearinate. Limbs very slender and elongate, femora unarmed beneath, cephalic and median genicular lobes bispinose, caudal genicular lobes unispinose: caudal femora about five-sixths as long as the tegmina, for the genus moderately inflated proximad.

Allotype.— ♀ ; Baixa Verde, State of Rio Grande do Norte, Brazil. (Stanford Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila.]

Differing from the description of the male sex in the features here specified. Lateral lobes of the pronotum faintly shorter in proportion to their depth, the latter contained one and one-half times in the greatest length of the same, caudal margin of lobes more flattened. Wings surpassing the apices of the tegmina by about one and one-half times the length of the pronotal disk. Abdominal segments of the more normal type, the penultimate segment with a faint median angular projection; supra-anal plate of the same general form as in the male, but without the greatly thickened margins; cerci of medium length, tapering, apices slender; ovipositor subequal in length to the dorsum of the head and pronotum, strongly arcuate, hardly bent proximad, slightly more than half of the dorsal margin and two-thirds of the ventral margin crenulato-dentate, surface of the valves distad with minute asperities; subgenital plate elongate trigonal, the apex weakly emarginate.

All the specimens of this species which we have seen, excepting one, have been preserved in a liquid preservative, and in consequence have lost all their coloration aside from certain brownish markings. This single individual (Bonito, State of Pernambuco, Brazil) shows that the base color of the head, thorax, abdomen and limbs is antimony yellow, of the tegmina and exposed portion of the wings lettuce green. The brownish lines, which are auburn to bay, mark the lateral carinae of the pronotal disk, the angle of the anal-discoidal fields of the tegmina and the greater portion of the sutural margin, also extending cephalad to and across the eyes. The base color of the latter is slightly paler than the bars. The antennae are more or less infuscate.

*Measurements (in millimeters)*

| | Independencia ♂ (*type*) | Baixa Verde ♀ (*allotype*) |
|---|---|---|
| Length of body (exclusive of ovipositor) | 16 | 18.1 |
| Length of pronotum | 3.5 | 3.9 |
| Greatest (caudal) width of pronotal disk | 2.8 | 2.9 |
| Length of tegmen | 25.8 | 24.5 |
| Greatest (median) width of tegmen | 4.2 | 4.8 |
| Length of wing distad of tegmen | 7.3 | 5 |
| Length of caudal femur | 20.4 | 19.7 |
| Length of ovipositor | | 5.7 |

In addition to the type and allotype we have before us six paratypes from the following localities and sources:

Independencia, State of Parahyba, Brazil; (W. M. Mann); one male.

Baturite Mountains, State of Ceará, Brazil; (W. M. Mann); three males, one female.

Bonito, State of Pernambuco, Brazil; (A. Koebele); one male; [U. S. N. M.].

We have also examined two immature females from the Baturite Mountains. The only feature in the series which seems worthy of comment is the length of the ovipositor in the two females. The Baturite Mountains female has this considerably greater than in the allotype (6.5 instead of 5.7 mm.) and the apex is faintly more arcuate.

We take great pleasure in dedicating this species to Dr. J. C. Branner, the distinguished geologist, who led the expedition which secured the present material.

**Hyperophora abrupta** new species (Plate III, figs. 3 and 3a.)

This interesting species has much in common with *H. branneri*, having a similar general form and the same type of abbreviate male cerci, but the latter instead of having their expansion inflated, as in *branneri*, have it of a more usual (for the genus) form with the regular sculpture, the dorsal abdominal segments are more carinate mesad, the distal carinate segment less produced and the apices of the tegmina more acute.

Type.—♂; Natal, State of Rio Grande do Norte, Brazil. (Stanford Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila., Type no. 5296.]

Size medium: form elongate. Head with its dorsal length slightly more than one-half the dorsal length of the pronotal disk; occiput regularly declivent; fastigium quite acuminate, subcompressed, faintly elevated and weakly sulcate dorsad, apex very narrowly separated from the fastigium of the face, the latter acute-angulate: eyes prominent when seen from the dorsum, subcircular in basal outline, their depth very slightly more than one-half that of the infraocular portion of the genae: antennae as usual in the genus, proximal joint relatively shorter and broader than in *branneri*. Pronotum shorter than in *branneri*, equally sellate, the disk of the pronotum with its greatest caudal width equal to three-fourths of the greatest length; margins of disk and lateral angles as in *branneri;* depression on disk as in *branneri:* lateral lobes of pronotum with the greatest depth of the same contained one and one-half times in

the greatest length; cephalic margin of the same slightly sinuate, angles and remaining margins of the lobes as in *branneri*. Tegmina falling very slightly short of the tips of the caudal femora, failing to reach the apices of the wings by slightly more than the dorsal length of the pronotum, in form moderately lanceolate, broader than in *branneri*, apex narrowly rounded, sutural in position, the form faintly tapering from the proximal third: mediastine vein incomplete; discoidal vein with three regular rami to the sutural margin, these with the usual connecting sectors: stridulating field proportionately shorter and broader than in *branneri;* for venation see figure. Wings with the distal portion subcoriaceous like the tegmina, apex injured in type, presumably acuminate. Abdominal segments weakly carinate dorsad, the penultimate dorsal abdominal slightly produced mesad into an obtuse-angulate, dorsad compressed projection, which bears a number of setae, lateral margins of this projection very faintly arcuate-emarginate: disto-dorsal abdominal segment strongly transverse, narrow, mesad broadly obtuse-angulate emarginate: supra-anal plate subtrigonal, distal margin obtuse-angulate and thickened and hirsute as in *branneri;* cerci of a character which much suggests those of *brasiliensis* and *peruviana* with the slender distal portion missing, the shaft is tapering to about the distal two-thirds, straight when seen from the dorsum, slightly ascending distad when seen from the side, distal third bent inward and subdepressed, expanding into a structure of the type placed mesad in *brasiliensis* and allied species, the distal prong narrowing and with a blunt tooth, the proximal section broader and excavate with a short, recurved, apical tooth, the free (internal) margin of this process sigmoid in outline, the portion proximad thickened: subgenital plate as in *H. branneri*. Limbs less elongate than in *H. branneri;* femora unarmed beneath, cephalic and median genicular lobes bispinose, caudal genicular lobes unispinose; caudal femora very slightly shorter than the tegmina.

General color pyrite yellow passing into pale old gold on the head and pronotum and to courge green distad on the tegmina and wings. Antennae distad of and including the second joint washed with pale morocco red, weakening distad; eyes brussels brown. Pronotum with the lateral angles of the disk lined with pale morocco red. Tegmina with the region of the anal vein broadly washed with dull claret brown. Femora more or less suffused with pale morocco red. Abdomen largely dull aniline yellow.

Length of body, 16 mm.; length of pronotum, 3.6; greatest (caudal) width of the pronotal disk, 2.9; length of tegmen, 22.8; greatest width (at proximal third) of tegmen, 4.2 ; length of caudal femur, 21.

The type of this interesting species is unique.

**Dolichocercus**[2] **peruvianus** (Brunner)

1891. *Hormilia peruviana* Brunner, Verh. K.-K. Zool.-botan. Gesell. Wien, xli, p. 117. [Sarayacu, Peru.]

Pará, Pará. (C. F. Baker.) One female.

[2] See Rehn and Hebard, Trans. Am. Ent. Soc., xl, pp. 39 and 40, (1914).

We are referring this specimen tentatively to *peruvianus*. It agrees with the description very well, yet has the tegmina slightly broader mesad (3.6 mm. instead of 3); however, as the whole insect is somewhat larger than Brunner's measurements this difference may be entirely proportional.

**Ceraia grandis** new species (Plate III, figs. 4 and 5.)

Apparently related to *C. tibialis* and *maxima* Brunner, the former from Fonteboa, upper Amazonia, the latter from Sorata, Bolivia; differing from *tibialis* in the less arcuate ovipositor, less strongly spined ventral margins of the caudal femora, broader tegmina and certain features of the coloration, such as the absence of blackish from the caudal tibiae. From *maxima*, to which it is apparently more nearly related, the new form can be distinguished by the shorter caudal femora, more numerous teeth on the ventral margins of the same, the shorter ovipositor and the non-ferruginous caudal tibiae. The male sex of both of the older species is unknown, so comparisons have been made solely on the basis of the female.

Type.—♂; Porto Velho, Rio Madeira, Brazil. (Stanford Expedition; Mann and Baker.) [Acad. Nat. Sci. Phila., Type no. 5299.]

Size very large (equal to some individuals of the genus *Stilpnochlora*): form subcompressed: surface moderately polished. Head with the occiput gently arcuate, hardly elevated dorsad of the general level of the pronotum; fastigium subhorizontal, compressed, faintly sulcate, the apex weakly bulbous and in contact with the rather elongate, subequal, facial fastigium: eyes hardly prominent when seen from the dorsum, nearly circular in basal outline, their depth faintly greater than that of the infra-ocular portion of the genae: antennae reaching to the tegminal apices. Pronotum with the disk deplanate, its greatest caudal width equal to three-fourths of the greatest length of the same: cephalic margin of disk very faintly arcuato-emarginate, caudal margin strongly arcuate, forming more than the curve of a quadrant; lateral angles of disk well rounded cephalad, narrowly rounded but of distinct character caudad; surface of disk sparsely impresso-punctulate, particularly caudad, with the median figure very broadly U-shaped, the caudal section of the disk somewhat depressed below the general level: lateral lobes of the pronotum with the greatest depth surpassing the greatest length of the same, cephalic margin sinuate, ventro-cephalic angle, ventral margin and ventro-caudal angle regularly and strongly arcuate, caudal margin arcuate, humeral sinus rotundato-rectangulate. Tegmina with their length slightly more than six times that of the pronotal disk, in form rather elongate lanceolate, the greatest width

contained more than four times in the length; costal margin gently arcuate throughout but more flattened proximad; sutural margin straight for the greater portion of its length distad of the stridulating field, distal fifth of the margin oblique rotundato-truncate, the apex nearer the costal margin and rotundate-acute; mediastine vein short, irregular, ramose; humeral and discoidal veins contiguous to about the middle of the tegmen, distinctly separated thence; median vein diverging at the proximal two-sevenths of the tegmen, bifurcate faintly distad of its middle, the rami reaching the oblique portion of the sutural margin; ulnar vein straight, except for a faint distal curve toward the sutural margin; transverse nervures rather regularly spaced and quite distinct; stridulating field with the oblique vein strong, broad, depressed, the field heavily coriaceous and strongly punctato-reticulate. Wings surpassing the tegmina by faintly more than the length of the pronotal disk, acute. Prosternum unspined; mesosternum with slightly acute-angulate lobes; metasternum with the lobes rounded laterad, the two lobes are produced meso-caudad into an acute projection around the metasternal foramen. Disto-dorsal abdominal segment large, distal margin deflexed mesad, when seen from the dorsum obtuse-angulate impressed, and when seen from the caudal aspect with that portion of the margin itself subtruncate with a narrow median, V-shaped fissure, laterad of this median section the margin is rotundato-rectangulate with a short but distinct, thick, styliform, articulate process: cerci rather stout, thickened distad, gently incurved and arcuate ventrad, the apex with a rectangulate-reflexed, acute spine, directed dorso-mesad: subgenital plate greatly elongate, arcuate when seen from the lateral aspect, through the greater portion of its length subequal in width, slightly expanding distad, the distal extremity rounded obtuse-angulate emarginate, ventral surface with three elevated ridges, the lateral or marginal ones thinner but more decided than the median one. Cephalic and median femora unarmed beneath: cephalic tibiae with three spines on the dorso-caudal margin; median tibiae with five spines on the same margin. Caudal femora equal to slightly more than two-thirds of the length of the tegmina, armed on the ventro-external margin with four and on the ventro-internal margin with six to seven spines, genicular lobes of caudal femora bispinose.

Allotype.— ♀ ; same data as type. [Acad. Nat. Sci. Phila.]

The features here given for the female sex are the unisexual ones not given in the above description of the male type. Pronotum with the humeral sinus well rounded obtuse-angulate. Disto-dorsal abdominal segment damaged; ovipositor slightly more than half again as long as the pronotal disk, arcuate proximad, nearly straight distad, faintly and regularly narrowing in width throughout; apex subangularly rounded, slightly oblique subtruncate ventrad; surface punctulate; distal half of dorsal margin, apex and extremity of ventral margin serrulato-denticulate: subgenital plate broad, lateral margins arcuate-emarginate, coverging distad; distal margin subtruncate; in section the plate is elevated mesad with a pair of converging folds laterad of the same. Caudal femora with the ventro-lateral margin bearing as many as six spines, the ventro-internal margin as many as eight spines.

General color oil green, the head, pronotum, pleura, abdomen, tegmina, exposed portion of the wings and limbs to variable degrees, wax yellow to aniline yellow, but to what degree the yellow is natural and not due to drying or discoloration we cannot say. Eyes sudan brown. Antennae argus brown in the greater portion of their length. Ovipositor with the tip and distal portions of the margins argus brown.

*Measurements (in millimeters)*

| | ♂ (*type*) | ♂ (*paratype*) | ♂ (*paratype*) | ♀ (*allotype*) |
|---|---|---|---|---|
| Length of body (in ♀ exclusive of ovipositor) | 29.5 | 28.5 | 28 | 31.8 |
| Length of pronotum | 8 | 7.9 | 7.1 | 8 |
| Greatest (caudal) width of pronotal disk | 6 | 6.1 | 5.7 | 6.7 |
| Length of tegmen | 51.3 | 48.6 | 47.2 | 54.6 |
| Greatest width of tegmen | 12 | 11.8 | 10.8 | 13.4 |
| Length of caudal femur | 35 | 35.5 | 33 | 36.7 |
| Length of ovipositor | | | | 13.2 |

In addition to the type and allotype we have before us two paratypic males, bearing the same data as the described specimens. The spines on the ventral margins of the caudal femora vary in number, on the external margin from four to six, and on the internal margin from five to eight, one individual having four on one external and six on the other, while another specimen has five on one internal and seven on the other. In all the more important features the four specimens are quite constant.

**Ceraia madeirensis** new species (Plate III, figs. 6 and 7.)

While we have only the female sex of this species it shows sufficient separation, in the way of differential characters, to make its description necessary. It is apparently nearest to *C. punctulata* and *dentata* Brunner, but from the former it differs in the rounded instead of trigonal metasternal lobes, in the ovipositor having but the distal extremity of the ventral margin crenulate and in its lesser size. From *dentata* the angulate mesosternal lobes will immediately separate *madeirensis*.

We do not think the present form could be the female sex of *C. surinamensis* Brunner, known only from the male. The new species has some similarity to *C. festae* Giglio-Tos, described from Ecuador and of which we have both sexes, but differs in the form of the lateral lobes, proportions of the tegmina, relative size of

the ovipositor and limbs and the form of the subgenital plate. It has much resemblance to *cornutoides* Caudell, from Paraguay, northern Argentina and south-central Brazil, but the subgenital plate of the female is different and the insertion of the lateral lobes distinctive.

Type.—♀; Porto Velho, Rio Madeira, Brazil. (Stanford Expedition; Mann and Baker.) [Acad. Nat. Sci. Phila., Type no. 5301.]

Size average for the genus: form moderately compressed: surface with the polish usual in the genus. Head with the occiput weakly arcuate, faintly elevated dorsad of the plane of the pronotum, slightly flattened cephalad; fastigium moderately declivent, weakly sulcate, the apex weakly bulbous and separated by a distinct, transverse depression from the remainder of the fastigium, the apex fully in contact with the relatively narrow facial fastigium: eyes hardly prominent, subcircular in basal outline, this slightly flattened cephalad; depth of the eye faintly greater than that of the infra-ocular portion of the genae. Pronotum with the disk deplanate, the greatest caudal width of the latter contained one and one-third times in the greatest length of the disk: cephalic margin of the disk subtruncate; caudal margin strongly arcuate, forming more than a quadrant; lateral angles of the disk narrowly rounded, more broadly so cephalad than elsewhere; surface of the disk rather sparsely punctate, median figure broadly U-shaped, deeply impressed: lateral lobes distinctly deeper than long; cephalic margin sinuate, thence regularly arcuate ventrad, caudad and finally dorsad to the infra-humeral obtuse-angulation, humeral sinus rotundato-rectangulate. Tegmina surpassing the apices of the caudal femora by slightly more than the length of the pronotal disk, elongate lanceolate, greatest width contained four times in the greatest length of the tegmen: costal margin arcuate distad, somewhat flattened proximad; sutural margin distad of the anal field straight except in distal sixth, where it is obliquely rotundato-truncate, the apex broadly rounded acute-angulate: mediastine vein subobsolete, very short; humeral and discoidal veins contiguous in proximal half, moderately separated thence distad; median vein diverging from the discoidal vein at about the proximal third, bifurcate, the branches reaching the sutural margin at the arcuation where the oblique distal portion of the margin joins the major portion; ulnar vein faintly sinuate; transverse nervures numerous, well marked, subparallel, oblique. Wings surpassing the apices of the tegmina by one and one-half times the dorsal length of the pronotal disk, apex subacute. Prosternum unarmed; mesosternal lobes rectangulate; metasternal lobes arcuate laterad, subtruncate caudad. Abdomen with the disto-dorsal segment weakly tectate, the surface impressed on each side of the median line, distal margin subtruncate with a very slight, shallow V-emargination mesad, distinct emarginations present at the cercal bases: supra-anal plate rectangulate, surface with a U-shaped depression: cerci rather short, incrassate, the tips sharply attenuate, general form of the cercus somewhat arcuate: infra-cercal plates subreniform in outline, surface

weakly strumose ventrad: ovipositor faintly more than one and one-half times as long as the disk of the pronotum, moderately arcuate in proximal half, thence distad nearly straight, faintly tapering; dorsal margin bent arcuate at the proximal third, thence straight to the rotundato-truncate apex, ventral margin moderately arcuate; distal half of dorsal margin, apex and extremity of ventral margin serrulate: subgenital plate trigonal, with the apex rotundato-truncate. Cephalic and median femora unarmed ventrad; cephalic tibiae with two to three spines on the dorso-caudal margin. Caudal femora three-fourths as long as the tegmina, relatively slender, genicular lobes briefly bispinose, ventro-external margin with three spines, ventro-internal margin with six to seven spines.

Coloration almost completely destroyed by immersion in liquid preservative. The discoidal field of the tegmina shows two, and traces of a third, longitudinal series of darker spots. The foramina on the cephalic tibiae and all of the infra-cercal plates except their small strumose section, black.

Length of body (exclusive of ovipositor), 24 mm.; length of pronotum, 5.7; greatest dorsal (caudal) width of pronotum, 4.6; length of tegmen, 36.5; greatest width of tegmen, 9.2; length of caudal femur, 27.2; length of ovipositor, 9.5.

The type is unique.

**Ceraia cornuta** Brunner

1891. *Ceraia cornuta* Brunner, Verhandl. K.-K. Zool.-botan, Gesell. Wien, xli, p.130. [Fonteboa, Amazonas, Brazil.]

Pará, Pará. (C. F. Baker.) One female.

This specimen full agrees with the original description, based on the male sex, in the characters found in both sexes. The characters of the female genitalic features are summarized to help in the recognition of that sex of the species. Anal segment (disto-dorsal abdominal segment) as in the male; supra-anal plate small, acute trigonal; cerci stout at base, regularly tapering, arcuate incurved, apex acute: ovipositor in length half again as long as the pronotal disk; moderately bent arcuate at the proximal third of the dorsal margin, this straight distad, ventral margin regularly arcuate; depth of ovipositor subequal, apex rotundato-subtruncate, crenulato-denticulate on distal third of dorsal margin, at apex and briefly on the ventral margin: subgenital plate V-shaped in section, short, distal margin bisinuate emarginate: infra-cercal plates produced ventro-distad in an acute, digitiform, compressed lobe, which moderately embraces the ovipositor base. This specimen measures as follows: length of body (exclusive of ovipositor), 23.2 mm.; length of pronotum, 6.7; greatest (caudal) width of pronotal disk, 4.5; length of

tegmen, 38.8; greatest width of tegmen, 8.5; length of caudal femur, 28.2; length of ovipositor, 9.6.

The species was previously known only from the type locality.

**Euthyrrhachis gracilis** Brunner

1878. *E[uthyrrhachis] gracilis* Brunner, Monogr. der Phaneropt., p.331, pl. vii, fig. 95. [Paramaribo, Surinam.]

Porto Velho, Rio Madeira. (M. Bolton.) One female.

Igarapé-assú, Pará. (H. S. Parish.) One male.

In the original description Brunner states that the cephalic and median femora are unspined ventrad, but later he modifies this to "submutica" and "raro-spinulosa."[3] In both of the present specimens the ventro-cephalic margins of the cephalic femora have two to four, and of the median femora, four spines. The ventro-external margins of the caudal femora bear six spines in the female and six to seven in the male; the ventro-internal margins of the caudal femora bear seven to nine spines in the female, six to seven in the male.

The species has been previously recorded from Paramaribo, Surinam and Fonteboa, upper Amazonia.

**Scaphura nigra** (Thunberg)

1824. *Gr[yllus] niger* Thunberg, Mém. Acad. Imp. Sci. St. Pétérsb., ix, p. 415. [Brazil.]

Baturite Mountains, Ceará. (W. M. Mann.) One female.

This specimen is similar to that described by Perty as *ferruginea*,[4] except for the restriction of chalybeous on the abdomen to mere edgings on the proximal segments and its complete absence from the limbs, while the ochraceous patch on the ventral section of the lateral lobes of the pronotum, mentioned by Perty, is well marked. It is somewhat smaller than the average from southern Brazil and Paraguay, but does not appear separable from those from more austral localities.

**Steirodon validum** Stål

1874. *S[teirodon] validum* Stål, Recen. Orthopt., ii, p. 44. [No locality.]

Obidos, Pará. One female.

[3] Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, p. 132, (1891).

[4] Delect. Anim. Art. Brasil., p. 120, pl. xxiii, fig. 11, (1834).

The only published records of this species are from Surinam; Brazil and Sapucay, Paraguay.[5]

**Peucestes striolatus** Brunner

1878. *P[eucestes] striolatus* Brunner, Monogr. der Phaneropt., p. 366. [Pernambuco and Bahia, Brazil; Panama; Peru.]

Pará, Pará. (C. F. Baker.) One female.

Porto Velho, Rio Madeira. (Mann and Baker.) One male.

This striking species also has been recorded from Cayenne; Archidona, Ecuador; eastern Bolivia and Central America, in addition to the localities given above.

**Posidippus citrifolius** (Linnaeus)

1758. [*Gryllus (Tettigonia)*] *citrifolius* Linnaeus, Syst. Nat., ed. x, p. 429. ["Indiis."]

Porto Velho, Rio Madeira. (Mann and Baker; M. Bolton.) Two males.

For comments on this species see the recent paper by the author on *Posidippus* and allied genera.[6]

**Anaulacomera**[7] **albonodulosa** Brunner

1891. *Anaulacomera albonodulosa* Brunner, Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, pp. 141, 145. [Upper Amazons.]

Pará, Pará. (C. F. Baker.) Three males, two females.

Piexe Boi, Pará. November to December, 1907. (Harriet B. Merrill.) One female.

[5] The record by us of this species from Costa Rica (Proc. Acad. Nat. Sci. Phila., 1905, p. 807, (1906)), is incorrect, the specimen being, instead, *Peucestes dentatus*.

[6] Entom. News, xxviii, p. 117, (1917).

[7] In 1875, Scudder erected a genus *Anallomes* (Proc. Boston Soc. Nat. Hist., xvii, p. 261), based on two new species, *A. unipunctata* and *A. maranona*, both from the eastern slope of the Peruvian Andes. The former species was described from a unique male, the latter from a unique female, the two types now being before us. Both have been greatly battered in the course of time, and are greatly shrivelled and discolored, as they were dried from alcohol. The first species, *A. unipunctata*, is identical with *Phylloptera serva* Brunner (Monogr. der Phaneropt., p. 313, (1878)), described from Central Peru, while the second species, *A. maranona*, is an *Anaulacomera*, either identical with or extremely close to *A. nodulosa* Stål. Females of *Anaulacomera* without accompanying males are extremely difficult, if not impossible, to determine with certainty. Kirby (Synon. Catal. Orth., ii, p. 434, (1906)), has designated *maranona* as the genotype, which makes the genus a synonym of *Anaulacomera*, as the latter name has two years' priority over *Anallomes*.

The series before us fully agrees with the description of this species, to which it invariably runs in working over Brunner's key, except for two discrepancies. The subgenital plate of the male is described as triangularly emarginate, while in one male the margin is truncate, in another arcuate-emarginate, while the third has the margin abnormally compressed and not comparable. Other material of the species, now before us, does show this margin varying to subtriangularly emarginate. The margins of the ovipositor are described as "non crenulatis," which is true to the extent that they are more distinctly serrulate.

The species has not been recorded since the original description. Its produced, strongly incurved cerci of the male are quite distinctive as far as our acquaintance with the genus goes.

**Anaulacomera angusta** Brunner

1891. *Anaulacomera angusta* Brunner, Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, pp. 142, 147. [Upper Amazons.]

Pará, Pará. (C. F. Baker.) One male.

Not previously recorded aside from the original description.

**Anaulacomera rusa** new species (Plate III, figs. 8 and 9.)

Apparently allied to *A. harpago* Brunner, but differing in the femora having a few spines on their ventro-cephalic margins, in the cerci of the male being simply bifurcate distad, like the distal section of an antler of a deer of the genus *Rusa*, and in the bicarinate instead of tricarinate subgenital plate of the same sex. The supra-anal plate of the male is of the same elongate, greatly produced type said to occur in *harpago*. The form of the anal segment is so distorted from drying, the type having been in a liquid preservative, its exact form is hard to ascertain.

Type.—♂; Ceará-Mirim, State of Rio Grande do Norte, Brazil. (Stanford Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila., Type no. 5305.]

Size small: form compressed. Head with the occiput and vertex moderately declivent: fastigium strongly compressed, very narrow distad, apex finely subglobose and almost touching the fastigium of the face; dorsal surface of the fastigium finely sulcate, the lateral margins roundly elevated proximad: fastigium of the face rather long acuminate, immediate apex narrowly rounded: face moderately inflated and bullate, subcompressed: eyes moderately prominent, very broad ovate in basal outline, this slightly flattened ventro-cephalad: antennae distinctly surpassing in length the closed tegmina and wings: palpi

very slender; fourth joint about three-fifths as long as the third joint; fifth joint over half again as long as the third joint, subclavate distad. Pronotum with the dorsum subdeplanate, narrow, the greatest caudal width contained one and two-thirds times in the greatest length of the same, lateral margins of the disk narrowly rounded and but very faintly converging cephalad; cephalic margin of disk subtruncate, caudal margin of disk moderately arcuate: lateral lobes of pronotum faintly longer than deep; cephalic margin of lobes shallowly arcuato-emarginate, ventro-cephalic angle obtuse, ventral margin obliquely arcuate, ventro-caudal angle broadly rounding into the oblique, broadly arcuate caudal margin; humeral sinus decided, rotundato-rectangulate. Tegmina elongate, lanceolate, surpassing the apices of the caudal femora by slightly more than the length of the pronotal disk, greatest width contained about five and one-half times in the greatest length; costal and sutural margins subparallel, the former briefly rounding distad to the rounded, but distinct, apex, which is practically median; sutural margin with a distinct distal arcuation to the apex: median vein diverging slightly proximad of the middle, bifurcate distinctly before its middle: areolation distinct and regular: tympanal field relatively small and rather narrow, the free margin rounded obtuse-angulate at the apex of the stridulating vein. Wings surpassing the closed tegmina by a distance equal to three-fourths of the length of the pronotal disk, the apex of the closed wings rounded acute. Prosternum with an elevated V-shaped structure, but no spines: mesosternal lobes rectangulate at the apices, the caudal margins well arcuate: metasternal lobes narrow, obtusely arcuate. Supra-anal plate elongate, linguiform trigonal, the distal portion very narrow, rounded at apex: cerci slightly longer than the pronotal disk, slender, subcompressed, antler-like; when seen from the dorsum arcuate laterad in proximal section, passing to weakly arcuate to the medial line distad, the form in this view caliper-like; when seen from the side regular arcuate, with the convexity ventrad, the ramus diverging on the ventral surface at distal third, and the same is as long as the distal third of the main shaft of the cercus, of similar shape and form, and with it making a V-shaped structure, the immediate apex of the ramus briefly sigmoid hamate: subgenital plate broad, distinctly bicarinate, the carinae moderately diverging distad; free margin arcuate-emarginate distad, with distinct, subacute and submammillate projections at the extremities of the carinae. Limbs slender: caudal femora moderately inflated proximad, slender distad, the ventro-lateral margin of the same with two to five spines.

Coloration destroyed by immersion in liquid preservative. Tympanal field of tegmina shows several areas of fuscous.

Length of body (exclusive of cerci), 11.8 mm.[8]; length of pronotum, 3.5; greatest (caudal) width of pronotal disk 2.1; length of tegmen, 21; greatest width of tegmen, 3.7; length of caudal femur, 13.3; length of cercus, 4.3.

The type is unique.

[8] The body is much shrivelled and this measurement is undoubtedly less than the natural length.

**Anaulacomera ovibos** new species (Plate III, figs. 10, 11 and 12.)

Apparently not at all closely related to any of the previously known species of the genus, from all of which, excepting the following new species—*bovicula*, it differs in the extraordinarily recurved cerci of the male, these resembling in general form the horns of the musk-ox (*Ovibos moschatus*). The present species possesses other features which appear to mark it off, but the cereal characters are so distinctive for *ovibos* and the following species-*bovicula*, they alone need be cited to enable one to recognize the species. From *bovicula* the larger *ovibos* can be separated by the greater development of the cerci, which are greatly attenuated and recurved, recalling the horns of the musk-ox (*Ovibos moschatus*), the tips reaching dorsad almost to the base of the disto-dorsal abdominal segment. The genitalia of the two species are of essentially the same type, and no other important features of difference, but size, are evident, but the cerci of *bovicula* lack the extreme development found in *ovibos*.

The two species appear to belong in the section of the genus containing *A. intermedia* Brunner, with which they show affinity in the compressed fastigium, in the lateral lobes of the pronotum being longer than deep, in the presence of nodes along the humeral trunk in the proximal section of the discoidal field of the tegmina, and in all the femora being spinulose beneath.

Type.—♂; Baixa Verde, State of Rio Grande do Norte, Brazil. (Stanford Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila., Type no. 5325.]

Size medium: form compressed: surface smooth, except for sparse and very minute points scattered irregularly over the body; tegmina coriaceous. Head with the occiput gently arcuate: fastigium compressed, faintly narrower proximad than distad, the apex concavo-truncate, dorsal surface with a deep mediolongitudinal sulcation, lateral margins of fastigium strumoso-carinate, these rectangularly diverging and vanishing caudad; fastigium of the face separated from the fastigium of the vertex by the very narrowest interval: eyes moderately prominent, sub-orbicular in basal outline: antennae (incomplete) at least as long as the body: palpi very slender; third joint one and two-thirds times as long as the fourth joint; fifth joint somewhat less than twice as long as the third joint, very faintly enlarged distad. Pronotum with the dorsum subdeplanate, subequal in width, the greatest caudal width contained nearly twice in the length: cephalic margin of disk very slightly angular-emarginate, caudal margin moderately arcuate; median figure rectangulate, well impressed, caudal fourth of disk slightly depressed and somewhat different in texture from

the remainder; lateral portions of disk broadly rounding to the lateral lobes, appreciable but rounded shoulders present caudad, dorsad of the humeral sinus: lateral lobes faintly longer than deep; cephalic margin emarginato-truncate, ventro-cephalic angle obtuse, ventral margin oblique subtruncate, strongly descending ventro-caudad, ventro-caudal angle very broadly rounded, the whole caudal margin regularly arcuate to the subrectangulate humeral sinus. Tegmina surpassing the apices of the caudal femora by a distance slightly greater than the length of the pronotal disk, in form elongate lanceolate, the greatest width contained three and one-half times in the greatest length: costal margin regularly arcuate, except for a slight flattening in the distal half; apex well rounded; sutural margin moderately and regularly arcuate: marginal field with a number of rather regularly placed and directed, but irregularly branched and subobsolete, rami from the humeral vein; median vein diverging shortly distad of the middle, this furcate distinctly before its middle; ulner and median veins, their rami and cross-veins all sinuate and unstable in exact continuity; nodes paralleling the proximal half of the discoidal vein, four to five in number: stridulating field relatively small; stridulating vein strongly crassate, faintly arcuate, slightly oblique; free margin of field rounded obtuse-angulate at the apex of the stridulating vein. Wings surpassing the apices of the tegmina by a distance about equal to two-thirds the length of the pronotal disk: wing narrow, its greatest width contained about two and one-quarter times in the length of the same. Prosternum with a broad V-shaped structure: mesosternal lobes small, moderately arcuate laterad: metasternal lobes narrow, obtusely arcuato-truncate latero-caudad. Disto-dorsal abdominal segment deep, median section strongly deflexed ventrad between the cercal bases, terminating in a narrow, rounded protuberance, proximad from which extends a narrow and clearly defined sulcation; lateral sections of the same segment relatively broad, sub-lamellate, the ventro-distal angle subacute with the apex narrowly rounded: cerci quite elongate, cornuiform, rather thick at the base there with a short dorsal, arcuate carination; distad of the thickened base for a short distance they rather strongly and thence very regularly and gradually taper to the aciculate apex; the form, in general, is sharply falciform, being strongly arcuate in the proximal half, thence more gently but distinctly arcuate, their form considerably resembling that of the horns of the musk-ox; both faces (internal and external) of attenuate portion sulcate: subgenital plate short, broad at the base, strongly and regularly narrowing distad, the disto-median section of the margin narrowly arcuato-emarginate, this flanked by relatively short, fixed, styliform processes, lateral portions of the margin oblique truncate; surface of the plate with a medio-longitudinal carina and short, incomplete carinae at the bases of the styliform processes. Cephalic femora subequal in length to the pronotal disk, ventro-cephalic margin with five spines, ventro-caudal margin unarmed; median femora one and one-half times as long as the pronotal disk, ventro-cephalic margin with three spines distad, ventro-caudal margin unarmed. Caudal femora about three-fifths as long as the tegmen, moderately bullate proximad, very slender distad; ventro-external margin with four to five spines distad, ventro-internal margin with two to three distal spines.

Coloration completely destroyed by immersion in a liquid preservative, except for a short, velvety black line at the base of the anal vein, and several fuscous clouds on the stridulating field of the tegmina.

Length of body, 20.3 mm.; length of pronotum, 5.2; caudal width of pronotal disk, 3; length of tegmen, 28.2; greatest width of tegmen, 7.8; length of caudal femur, 17.

The type of this remarkable species is unique.

**Anaulacomera bovicula** new species (Plate III, figs. 13 and 14.)

The features separating this species from *A. ovibos*, its only close relative, which is described in the preceding pages, are given in the diagnosis of the latter species.

Type.—♂; Ceará Mirim, State of Rio Grande do Norte, Brazil. (Stanford Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila., Type no. 5326.]

This species is in general such a duplicate of *ovibos* that the following descriptive features are solely those of difference from the description of *ovibos*.

Size rather small. Fastigii of the face and vertex separated by a somewhat greater space than in *ovibos*. Tegmina surpassing the apices of the caudal femora by nearly twice the length of the pronotal disk, in length about three and one-third times as long as the greatest width. Disto-dorsal abdominal segment in its position and development as in *ovibos*, but the median section bears a squared (in section), elevated portion, which narrows in width distad, with distinct lateral margins to the same area, which also bears a mediolongitudinal, shallow and relatively broad sulcus, strongly declivent lateral slopes and a truncate extremity; lateral portions of the segment as in *ovibos;* cerci of the general type found in *ovibos*, but the thickened proximal portion is less pronounced and more weakly carinate, while the attenuate portion is much less extensive, the tips reaching dorsad only to the cercal bases, sulcate as in *ovibos:* subgenital plate as in *ovibos*. Cephalic femora with three spines on the ventro-cephalic margin; median femora with one to two spines on the ventro-cephalic margin. Caudal femora with two to three spines on the ventro-external margin, ventro-internal margin with two to three spines.

Coloration destroyed by immersion in a liquid preservative, the same black and fuscous markings indicated as found in *ovibos*.

Length of body, 14 mm.; length of pronotum, 4.6; caudal width of pronotum, 2.7; length of tegmen, 24.2; greatest width of tegmen, 6.8; length of caudal femur, 14.

The type is unique.

In addition to the species of *Anaulacomera* here recorded, we have in the present series females of three other very distinct species, which we are unable to place in any of the forms known

at this writing. We do not care to describe species of this genus from the female sex alone, so it seems most advisable to permit these specimens to remain undetermined until males of the species are discovered.

**Grammadera hastata** Brunner

1891. *Grammadera hastata* Brunner, Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, p. 150. [Cayenne.]

Porto Velho, Rio Madeira. (Mann and Baker.) One female.

This record and that by Giglio-Tos from Corumbá, Matto Grosso, Brazil,[9] are the only ones for the species since the original description.

**Viadana granulosa** (Brunner)

1891. *Ctenophlebia granulosa* Brunner, Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, p. 155. [Pebas, Upper Amazons (Peru).]

Pará, Pará. (C. F. Baker.) One male.

This specimen fully agrees with the ambisexual characters given by Brunner from the type female, and in proportions is identical, except for the caudal femora being slightly longer. The male genitalia fully agree with the description of those parts of *curvicercata* Brunner,[10] except that the cerci are without any appendage at the basal fourth or any other point.

The range of the species is seen to cover a considerable portion of Amazonia.

**Phylloptera ancilla** (Brunner)

1878. *Phylloptera ancilla* Brunner, Monogr. der Phaneropt., p. 312. [Surinam.]

Pará, Para. (C. F. Baker.) One female.

This striking species has, as far as we can ascertain, been recorded only from the type locality.

**Coelophyllum crassum** new species (Plate III, figs. 15 and 16.)

Related to *C. rectinerve* (Brunner) [*Prosagoga rectinervis* Brunner], as understood by us, but differing in the more robust form, the body being much less compressed, and the eyes, fastigium, face, pronotum and stridulating field of the tegmina being

[9] Bollett. Mus. Zool. Anat. Comp. Torino, xv, no. 377, p. 7, (1900).

[10] Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, p. 155, (1891).

broader, the lateral lobes of the pronotum more decidedly narrowed ventrad, the tegmina proportionately broader and more coriaceous and opaque, in the marginal field of the tegmina proportionately narrower, the ramus of the median vein of the tegmina forking faintly proximad of the middle, in the ulnar vein of the tegmina being more bent arcuate and closer to the median vein, and in the median and caudal limbs being longer. From the related *C. curvinerve* (Brunner), from Fonteboa, Brazil, the new species apparently differs in the more numerous femoral spines, the longer and narrower pronotum and the longer caudal femora.

Type.—♂; Pará, State of Pará, Brazil. (C. F. Baker.) [Acad. Nat. Sci. Phila., Type no. 5309.]

Size medium: form moderately compressed (less than in allies), robust (for the genus): surface smooth but unpolished; tegmina with a slight polish. Head relatively broad, its greatest width subequal to the depth from occiput to ventral angle of genae: occiput weakly arcuate declivent to the fastigium, this narrow, acuminate with the apex narrowly rounded, sulcate, moderately declivent, widely separated from the fastigium of the face, the latter slightly acute-angulate: face slightly bullate, weakly impressed carino-rugose ventrad of the eyes, genae not prominent: eyes directed cephalad, not projecting laterad, their basal outline broadly subreniform-ovate, the cephalic trend of the convexity of the eye quite pronounced: antennae incomplete. Pronotum relatively broad, the dorsum distinctly deplanate: greatest dorsal (caudal) width of disk contained one and two-fifths times in the greatest length of the same; cephalic margin of disk distinctly but not strongly arcuato-emarginate: caudal margin of disk broadly and quite strongly arcuate; lateral angles of disk weakly diverging caudad, rounded, distinct except cephalad, where they are obsolescent; metazona with a distinct medio-longitudinal sulcus: lateral lobes of pronotum appreciably deeper than long, moderately narrowing ventrad; cephalic margin oblique subtruncate, ventro-cephalic angle rounded obtuse, ventral margin briefly oblique truncate, passing through the broadly rounded ventro-caudal angle into the slightly oblique, arcuato-truncate caudal margin, humeral sinus distinct but shallow, rotundato-rectangulate. Tegmina relatively broad, subrectangulate-elliptical, surpassing the apices of the caudal femora by the dorsal length of the head and pronotum combined, greatest width (median) contained two and one-half times in the greatest length, width at distal fourth contained slightly more than three times in the length: costal margin straight, except proximad, where it is obliquely truncate to the base, the two sections broadly rounding one into another, and distad where it is moderately arcuate to the rounded rectangulate apex, which is slightly costal in position; sutural margin arcuate except distad, where it is slightly flattened and arcuate into the obliquely arcuato-truncate apical margin: marginal field very broad proximad, regularly narrowing distad:

venation not sharply defined, the fine neuration lost in the close coriaceous areolation: marginal field at its widest portion subequal to one-half the entire width of the widest portion of the tegmina, with a number of oblique, subparallel rami of the humeral vein, these generally bifurcate and poorly defined; median vein diverging slightly before the middle of the tegmen, bifurcate distinctly before the middle of the vein, the rami reaching the suturo-apical arcuate portion of the margin; ulnar vein proximad close to the discoidal vein, slightly but appreciably converging to its point of furcation, thence oblique straight to the sutural margin, the median width of this area of convergence equal to one-third the greatest distance between the ulnar and anal veins: stridulating field relatively elongate, narrow, its free margin broadly arcuate, the stridulating vein heavy, depressed, arcuate. Wings normally not projecting distad of the closed tegmina. Prosternum unspined: mesosternal lobes slightly acute trigonal, the apices relatively sharp: metasternal lobes oblique, arcuate with a median truncation of the margin. Disto-dorsal abdominal segment broadly depressed medio-longitudinally, well arcuate in section dorsad of the insertion of the cerci; distal margin projecting and deflexed between the cercal bases in a process which is arcuato-emarginate mesad, with short, rounded angulations laterad, from each of which, as well as from the middle of the margin, fine sulcations extend to the median depression of the segment: supra-anal plate deflexed, in fact directed ventro-cephalad, elongate trigonal: cerci relatively short, moderately incurved with the apex bent slightly inwards, tapering, the apex subcompressed and bearing a short, dorsal, corneous ridge, which forms the acute apex: subgenital plate moderately compressed, somewhat elongate, the lateral margins regularly converging distad, distal margin relatively narrow, subtruncate; styles very short, conical, articulate. Cephalic femora relatively robust, short, not longer than the lateral angles of the pronotal disk; ventro-cephalic margin of same with several extremely weak serrulations distad, ventro-caudal margin unarmed: cephalic tibiae appreciably longer than the femora, quite slender in distal half; tympanum large, open on both faces: median femora faintly longer than the pronotal disk; ventro-cephalic margin with one to two serrulations distad. Caudal femora about one-half as long as the tegmina, moderately inflated proximad and tapering quite gradually to the moderately slender distal section: ventro-external margin with seven to ten spines; ventro-internal margin with one to four spines; caudal genicular lobes bispinose.

General color of head and pronotum honey yellow to yellow ocher, becoming mustard yellow on the other thoracic segments and the abdomen, the tegmina passing into sulphine yellow and finally (covering a variable portion distad) into lettuce green, the limbs yellow ocher to buckthorn brown. It is quite probable that shades of green were the normal color tones and that the present coloration is not that of life, but the specimen shows little discoloration and has not been immersed. Eyes russet. Pronotum with the lateral angles of the disk rather obscurely lined laterad with dull primuline yellow, and mesad narrowly with burnt lake, both faintly indicated in the postocular region of the head. Tegmina with numerous, very small specklings of liver brown, while

at the fork of the ulnar vein there is one large, and on the main branch of the same vein and on each ramus of the median vein, disposed with the curve of the sutural margin, three small blotches of the same color. Wings colorless hyaline with the veins pale yellowish.

Length of body, 22.7 mm.; length of pronotum, 6.2; greatest width (caudal) of pronotal disk, 4.6; length of tegmen, 30; greatest width of tegmen, 11; length of caudal femur, 15.5.

The type is the only specimen of the species we have seen.

**Pycnopalpa bicordata** (Serville)

1825. *Locusta bicordata* Serville, Encycl. Méthod., Ins., x, p. 343. [Brazil.]

Independencia, Parahyba. (Mann and Heath.) One male.

This specimen has the distal portion of the costal margin of the tegmina more regularly arcuate and less truncate than in Rio de Janeiro material.

**Microcentrum lanceolatum** (Burmeister)

1838. *Ph[ylloptera] lanceolata* Burmeister, Handb. der Entom., ii, abth, ii, pt. i, p. 692. [Brazil.]

Ceará Mirim, Rio Grande do Norte. (Mann and Heath.) One female.

This species has been recorded from localities extending from Guatemala and Surinam to southern Brazil.

**Microcentrum marginatum** Brunner[11]

1878. *M[icrocentrum] marginatum* Brunner, Monogr. der Phaneropt., pp. 334, 336. [Pernambuco, Brazil.]

Ceará Mirim, Rio Grande do Norte. (W. M. Mann.) One female.

Independencia, Parahyba. (Mann and Heath.) One male.

The stridulating vein of the stridulating field of the male of this species is very heavy, long, strongly arcuate and with its paralleling vein but little inferior in development.

**Microcentrum nigrolineatum** (Bruner)

1915. *Orophus nigrolineatus* Bruner, Ann. Carneg. Mus., ix, p. 333. [Province of Sara, Bolivia.]

Pará, Pará. (C. F. Baker.) One male.

Chanchomayo, Peru. Two females.

[11] The specimen from Misiones, Argentina recently recorded by us as *M. angustum* (Proc. Acad. Nat. Sci. Phila., 1915, p. 288), we find, on re-examination and comparison with the present material, to represent *M. marginatum*.

This is a very clearly marked species, the striking peculiarities of its coloration greatly assisting in its ready recognition. It will be seen to have quite an extensive distribution.

PSEUDOPHYLLINAE

**Lichenochrus variabilis** Brunner

1895. *Lichenochrus variabilis* Brunner, Monogr. der Phaneropt., p. 128. [Pernambuco, Brazil; Columbia (err. pro Colombia).]

Ceará-Mirim, Rio Grande do Norte. (W. M. Mann.) Two males, one female.

Natal, Rio Grande do Norte. (W. M. Mann.) Two males, three females, one immature male.

Independencia, Parahyba. (Mann and Heath.) One male.

The greater portion of this material has been seriously affected by immersion in a liquid preservative. The coloration has been largely destroyed and nothing but the more decided contrasts of the pattern remain in the affected material, while the pronotal form apparently has been altered so greatly in some of the males, by the action of the preservative on the chitin, that on first examination a different species appears to be represented. There is, however, no question of the specific identity of the material. The size varies very considerably, the majority of the individuals being over, rather than under the original measurements. A striking feature, not mentioned by Brunner, is the paired lateral areas of shining brownish-black on the abdominal segment preceding the disto-dorsal one. There is a tendency in the same direction dorsad on the disto-dorsal segment of the male.

**Teleutias tortus** new species (Plate III, figs. 17 and 18.)

A small species related to *T. brevifolius* and *nigro-tarsatus* Brunner, from the upper Amazonian region, but differing from the former in the shorter tegmina in both sexes, and the shorter femora, the non-hirsute disto-dorsal abdominal segment of the male and the continuous character of the pronotal cariniform markings, which are as distinctly indicated on the metazona as on the metazona. From *nigro-tarsatus* the new form differs in the median femora having two or three spines on the ventro-cephalic margin, in the shorter cerci of the male, the non-incurved styles of the subgenital plate of the same sex and in the third tarsal joint not being black. From all the other species of the genus,

the new form apparently differs in the caudal genicular lobe of the cephalic femora and the cephalic genicular lobe of the median femora being rounded and unspined.

Type.—♂; Madeira-Mamoré Railroad Company Camp No. 39, Rio Madeira, Brazil. (Stanford Brazilian Expedition; Mann and Baker.) [Acad. Nat. Sci. Phila., Type no. 5320.]

Size small: form greatly compressed: surface of face obscurely punctulate, of pronotum granulose, of the entire body, except dorsum of abdomen, and of the tegmina more or less thickly pilose. Head with the fastigium not reaching to the margins of the antennal scrobes, this in form distinctly acute, sulcato-excavate distad, subtuberculate proximo-laterad, the apex slightly upcurved when seen from the side: eyes moderately prominent, short ovoid in basal outline: antennae greatly elongate, over two and one-half times as long as the body, proximal joint with a distinct spinous projection distad. Pronotum in general subcylindrical, faintly constricted mesad, faintly sellate, the greatest caudal width of the disk subequal to the cephalic width of the same and contained nearly twice in the length of the disk: cephalic margin of the disk weakly arcuate with a suggestion of a median tubercle; caudal margin of disk moderately arcuate with an intimation of a median emargination; lateral margins of the disk formed by weak sub-strumose ridges which are strikingly colored, these narrowing slightly cephalad, subparallel mesad and distinctly diverging over the greater portion of the metanotum: principal transverse sulcus placed slightly caudad of the middle, deeply impressed, continued ventrad over the whole of the lateral lobes; cephalic transverse sulcus equidistant from the cephalic margin and the principal sulcus, well impressed: lateral lobes distinctly longer than deep, the cephalic depth contained about twice in the greatest dorsal length of the lobes; ventral margin of the lobes slightly but appreciably ascending caudad; ventro-cephalic angle of lobes broadly rounded subrectangulate, ventro-caudal angle of lobes obtuse. Tegmina subcoriaceous, lanceolate, reaching to the apices of the caudal femora, the greatest width contained four and three-quarters times in the greatest length of the same: costal margin straight mesad, briefly arcuate proximad and distad; sutural margin straight; distal extremity narrowly rounded: stridulating field in length equal to about two-thirds that of the pronotum; mirror of the left tegmen translucent, of the right tegmen hyaline. Wings with their greatest width contained one and one-half times in their greatest length: costal margin nearly straight, apex narrowly rounded rectangulate, periphery regularly arcuate. Prosternal spines elongate: mesosternal lobes rounded rectangulate; metasternal lobes hardly produced, arcuate; metasternal foveolae slightly longitudinal. Disto-dorsal abdominal segment sinuato-arcuate distad, the distal half of the segment with an impressed median sulcus: supra-anal plate transverse trigonal, the surface slightly inflated and with a deeply impressed medio-longitudinal sulciform fossa, which fails to reach the somewhat rounded apex of the plate: cerci very short, inflated, bulbous in proximal portion, the apical section sharply reflexed, tapering, the immediate apex aciculate, directed

proximad in the direction of the base of the opposite cercus, pilose: subgenital plate short, broad, disto-mesad U-emarginate; styles but little shorter than the subgenital plate, elongate lanceolate, depressed, apex blunted, pilose. Cephalic femora subequal to the dorsal length of the head and pronotum together, armed on the ventro-cephalic margin with two spines on the distal half; cephalic genicular lobe spined, caudal one rounded; cephalic tibiae with the foramina compressed conchate. Median femora subequal to the cephalic femora in length, ventro-cephalic margin with three spines in distal half, cephalic genicular lobe rounded, caudal genicular lobe spined; median tibiae moderately compressed, weakly inflated proximad, dorsal margins unarmed. Caudal femora but slightly longer than the tegmina, moderately inflated proximad, ventro-cephalic margin with four to five spines, genicular lobes spined.

Allotype.— ♀ ; Porto Velho, Rio Madeira, Brazil. (Stanford Brazilian Expedition; Mann and Baker.) [Acad. Nat. Sci. Phila.]

Differing from the description of the male sex in the following features. Size medium. Antennae nearly twice as long as the body. Pronotum less elongate, the greatest caudal width of the disk contained one and two-thirds times in the greatest length of the disk. Tegmina falling short of the apices of the caudal femora by about the depth of the lateral lobes of the pronotum, lanceolate, rather regularly narrowing from the proximal third, the greatest width contained four times in the greatest length of the same. Supra-anal plate of the pattern found in the male: cerci short, weakly curved, robust proximad, tapering distad: ovipositor two-thirds as long as the caudal femora, arcuate in distal three-fifths, proximal two-fifths straight and subequal in depth; ventral margin thence regularly arcuate, very faintly serrulate; dorsal margin in distal three-fifths arcuate emarginate, this section crenulate, particularly proximad: subgenital plate transverse, the free margin arcuate, rectangulate emarginate mesad. Caudal femora slightly shorter than the tegmina.

General color (specimens dried from liquid preservative) buckthorn brown to dresden brown, the dorsal surface of the abdominal segments mummy brown, the distal margin of these segments on the dorsum and for some distance ventro-laterad narrowly clove brown. Venter and face cream-buff to chamois, the lateral facial carinae, the lateral carinae of the pronotum, their cephalic continuation on the head and the sutural margin of the tegmina of both sexes, as well as the bordering of the stridulating field of the tegmina of the male, lineate with naples yellow, more pronounced in the male than in the female. Face with the pale markings more or less distinctly outlined with mummy brown, labrum with the distal half dull bluish; eyes russet; antennae with a few widely spaced, cream-colored annuli, which are thrown into contrast by the darkening of the adjacent section. Pronotum with the dorsal section of the lateral lobes marked with clove brown, this varying from a narrow line to a broader cloud and throwing the adjoining pale carinal line into contrast: cephalic margin weakly, and caudal margin strongly, beaded with clove

brown. Tegmina with the venation pale and contrasted with the buckthorn brown of the interspaces and reticulations, which to the naked eye appear as stipplings. Wings weakly smoke hyaline, the costal section, humeral trunk, median and axillary veins washed with ochraceous-orange to ochraceous-tawny, remaining longitudinal veins lined and transverse veins washed with fuscous. Limbs buckthorn brown to ochraceous-tawny, the femoral extremities occasionally washed with cinnamon-brown. Ovipositor with distal half chestnut.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Greatest width of pronotal disk | Length of tegmen | Greatest width of tegmen | Length of caudal femur | Length of ovipositor |
|---|---|---|---|---|---|---|---|
| Madeira-Mamoré R. R. Company Camp 39. | | | | | | | |
| *Type* | 17.7[12] | 5 | 2.7 | 17.4 | 3.8 | 14 | |
| *Paratype* | 19.4[12] | 5 | 2.5 | 17.2 | 3.6 | 13 | |
| ♀ | | | | | | | |
| Porto Velho, Brazil. | | | | | | | |
| *Allotype* | 29 | 5.5 | 3 | 18.5 | 4.9 | 17.4 | 10.6 |

In addition to the type and allotype we have before us a paratypic male from the type locality, this specimen being measured above. The three specimens show no noteworthy features of variation, excepting in the number of spines on the ventro-cephalic margins of the femora. Those on the cephalic femora range from one to three, on the median femora from two to three, and on the caudal femora from four to six.

COPIPHORINAE

**Caulopsis gracilis** Redtenbacher

1891. *Caulopsis gracilis* Redtenbacher, Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, p. 377, pl. iii, fig. 25. [Brazil; Buenos Aires; Montevideo; Rosario; Cuba.]

Amazon River, one hundred knots west of Santarem. Two females.

These specimens have lost all of their original coloration from alcoholic immersion, and are also distinctly shorter in body length than the originally measured material, but the individual parts agree very well in dimensions. The reduction of body length is doubtless due to shrinkage in drying, or the Redtenbacher material was abnormally distended.

[12] Body greatly bent.

The specimen from Misiones, Argentina, previously recorded by us as this species with a query,[13] is different, representing instead *Neoconocephalus flavirostris* (Redtenbacher), described from São Paulo, Brazil.[14] As a matter of fact the genera *Caulopsis* and *Neoconocephalus* approach dangerously close to one another, their differences being solely in degree, and *flavirostris* is not far removed from *gracilis*. Without material of the genotype of *Neoconocephalus* (*N. subulatus*), we do not care to express ourselves further on the features separating the two genera, but we hope to be able to make the desired comparison some time in the future.

**Neoconocephalus xiphias** (Saint Fargeau and Serville)

1825. *L[ocusta] xiphias* Saint Fargeau and Serville, Encycl. Méth., Ins., x, p. 342. [Cayenne.]

Pará, Pará. (Thayer Exped.) One male. [M. C. Z.]

Porto Velho, Rio Madeira. (Mann and Baker.) Four females.

Rio Pacaya, Peru. August, 1912. One male. [A. N. S. P].

Two of the above females have retained their natural coloration, one greenish, the other brownish. There is some little variation in the exact attenuation of the distal extremity of the fastigium, but this is no greater than that found in most of the species of the group with produced fastigii.

We have not used *monoceros* of Stoll for this species, as done by Kirby, as we are uncertain of its application. From the figure it, with even more propriety, might be considered a *Copiphora*.

The present species has not been placed with certainty by any recent students of this group, but that it is closely related to *subulatus* (Bolivar) is evident. The only known record, aside from the type locality and those given above, is Santarem, Brazil (Walker).

**Neoconocephalus heteropus** (Bolivar)

1881. *Conocephalus heteropus* Bolivar, An. Soc. Españ. Hist. Nat., x, p. 496. [Itaparica, Bahia, Brazil.]

Independencia, Parahyba. (Mann and Heath.) Six males, three females.

All of these specimens have been dried after immersion in some liquid preservative, and in all the coloration has been injured,

[13] Proc. Acad. Nat. Sci. Phila., 1913, p. 374, (1913).

[14] Verhandl. K.-K. Zool.-botan. Gesell. Wien, xli, p. 386, (1891).

in several being almost completely destroyed. The extremes of both sexes in the series measure (in millimeters) as follows:

| | Length of body | Length of pronotum | Greatest (caudal) width of pronotal disk | Length of tegmen | Length of caudal femur | Length of ovipositor |
|---|---|---|---|---|---|---|
| ♂ | 27.2 | 7.4 | 4.5 | 37 | 21 | |
| ♂ | 27.4 | 8.1 | 4.9 | 41 | 23.5 | |
| ♀ | 29.2 | 7.5 | 4.5 | 47.2 | 26.7 | 28 |
| ♀ | 31.9 | 8 | 5.6 | 47 | 26.5 | 27.7 |

This species has been recorded from localities in eastern and southern Brazil, ranging from Parahyba to Espirito Santo (Lagoa Feia, Tocos; Bruner) and Corumbá, Matto Grosso (Giglio-Tos), west to Peru and Chile. The reference of West Indian material to this species by Redtenbacher and Brunner is, apparently, erroneous.

**Neoconocephalus infuscatus** (Scudder)

1875. *Conocephalus infuscatus* Scudder, Proc. Boston Soc. Nat. Hist., xvii, p. 265. [Eastern slope of the Peruvian Andes.]

Porto Velho, Rio Madeira. (Mann and Baker.) One female.

We have been able to compare this specimen with the unique type (♀) of the species in the Scudder Collection at the Museum of Comparative Zoology. The two are inseparable except for the much greater depth, in the type, of the infuscation of the ventral surfaces of all the femora. The type has shrivelled somewhat from drying after liquid immersion, but otherwise the specific features are clear. The dorsal surface of the base of the abdomen, the left tegmen and wing being spread, has been damaged by insect pests.

Measurements (in millimeters) of the two specimens are as follows:

| ♀ | Length of body | Length of pronotum | Greatest width of pronotal disk | Length of tegmen | Length of caudal femur | Length of ovipositor |
|---|---|---|---|---|---|---|
| Eastern slope of Peruvian Andes, *type* | 29.5 | 7.7 | 5 | 43.8 | 26 | 23.8 |
| Porto Velho, Brazil | 28.2 | 7.3 | 4.1 | 42.1 | 24.2 | 25.6 |

The species has been recorded from as far north as Cuba and St. Vincent, West Indies, south to southern Brazil (Theresopolis), west to Columbia, Ecuador, eastern Peru and Bolivia.

**Bucrates capitatus** (DeGeer)

1773. *Locusta capitata* DeGeer, Mém. Hist. Ins., iii, p. 455, pl. 40, fig. 1. [Unknown locality.]

Amazon, one hundred knots west of Santarem. One male.

Pacaya, Peru. September, 1912. One male.

This well known species already has been recorded from as far inland in the Amazon valley as Santarem, but the Pacaya specimen is the first one reported from upper Amazonia.

**Parabucrates brevicauda** (Scudder)

1869. *Conocephalus brevicauda* Scudder, Proc. Boston Soc. Nat. Hist., xii, p. 333. [Napo River, upper Amazonia.]

1881. *Bucrates cocanus* Bolivar, Anales Soc. Españ. Hist. Nat., x, p. 495. [Coca, Ecuador.]

Madeira-Mamoré Railroad Company Camp 39, Rio Madeira. (Mann and Baker.) One female.

Porto Velho, Rio Madeira. (Mann and Baker.) Three males, twelve females.

Porto Velho, Rio Madeira. (M. Bolton.) Two males, two females. [Cornell University.]

The synonymy of *Bucrates cocanus* with *brevicauda* is clearly evident from an examination of the material here studied, and from the original description of Bolivar's species. The name *cocanus* was based on the male sex, while the type and previously unique specimen of *brevicauda* is a female. This individual, belonging in the Scudder Collection at the Museum of Comparative Zoology, is now before us. It is in fairly good condition and measures as follows: length of body, 32 mm.; length of pronotum, 9.1; greatest caudal width of pronotal disk, 6.4; length of tegmen, 41.8; length of caudal femur, 22.5; length of ovipositor, 14. The series before us shows there is considerable variation in size in both sexes, but this is more pronounced in the male sex than in the female. Apparently all the specimens have been immersed in some liquid preservative, which has either destroyed or injured the general color tone, but in all the paired blackish pronotal lines are at least in part indicated. The black of the clypeal suture, on the internal portion of the mandibles, on the proximal antennal joints and on the ventral margins of the antennal scrobes is conspiciously and solidly indicated in all the specimens, except that the clypeal sutural marking occasionally weakens mesad.

This weakening is sometimes, but not invariably, associated with weakened paired pronotal lines.

The length of the tegmina is relatively uniform—surpassing the apices of the caudal femora by about the dorsal length of the pronotal disk—in all but one Porto Velho male, which has them but faintly surpassing the femoral tips. Such variation is known to occur in the related genus *Bucrates*, and it is a case of parallelism we find in the present genus.

The genus and species is known only from the upper Amazonian and Madeiran drainages.

LISTROSCELINAE

**Phlugis mantispa** Bolivar

1888. *Phlugis mantispa* Bolivar, Mém. Soc. Zool. France, i, p. 154. [Upper Amazonia.]

Ceará-Mirim, Rio Grande do Norte. (W. M. Mann.) Five males, one female.

Pará, Pará. (C. F. Baker.) One male.

Paramaribo, Surinam. (K. Mayo.) Six males.

The female specimen is somewhat smaller than the measurements of the unique type, but we can detect no other differences from the description. The species has been recorded from Mexico; Darien, Panama; La Guayra and Puerto Caballo, Venezuela; Cayenne; "Brazil"; Santarem and Urucum and Carandasinho, Matto Grosso, Brazil; Upper Amazonia; Porto Suarez, Bolivia; Asuncion, Paraguay and Formosa, Argentinian Chaco.

**Phlugis virens** (Thunberg)

1815. *C[onocephalus] virens* Thunberg, Mém. Acad. Imp. Sci. St. Petersb., v, p. 274. [No locality.]

Ceará-Mirim, Rio Grande do Norte. (W. M. Mann.) One female.

Pará, Pará. (C. F. Baker.) Two females.

The previous Brazilian records of this widely distributed species are Rio de Janeiro, Pará and Chapada, Matto Grosso.

## Gryllidae

### gryllotalpinae

**Gryllotalpa hexadactyla**[15] Perty

1832. *Gryllotalpa hexadactyla* Perty, Delect. Anim. Artic. Brasil., p. 119, pl. 23, fig. 9. [Mountains of Minas Geraës, Brazil.]

Rio Ucayali, Peru. Two females.

Rio Pacaya, Peru. July, 1912. Two females.

We record these specimens here chiefly as a reason for calling attention to a structural variation in the species. The dorso-internal margin of the caudal tibiae is normally unarmed in this species, but in one of the specimens from the Rio Ucayali, this margin on one limb bears a single median spine and on the other bears two spines. We have also examined a specimen from Bartica, British Guiana, which bears a single spine in this position on one caudal femur, while the other femur is unspined. A similar condition exists in seven specimens in the North American series of the species in the collection of the Academy,[16] while one female in the same series has a single spine on this margin of each femur.[17] Chopard has named this spined condition, variety *spinosa*,[18] but the evidence we have shows the futility of applying names to such variants. We also find, from the available series from North, Central and South America, that the presence of the paired rows of incurved chaetiform hairs on the disto-dorsal abdominal segment is correlated, in this species, with the development of the wings, the hairs being absent in short-winged individuals, faintly developed in those with a briefly caudate wing development, and well developed in those having fully caudate wings.

[15] We cannot consider *Neocurtilla* Kirby a distinct genus from *Gryllotalpa*, as variation in *G. hexadactyla* makes its definition on the basis of the spination of the dorso-internal margin of the caudal femora impossible. The frequent use of the name *Curtilla* in place of the far older *Gryllotalpa* as the generic name, is reprehensible, as nomenclatural tautonomy is not only a rather desirable thing, but has been sanctioned by the International Zoological Commission on Nomenclature in the matter of type fixation.

[16] Edge Hill, Penna.; X, 4, 1906; (W. Stone); 1 ♂: Collingdale, Penna.; V, 19, 1902, (P. Laurelliere); 1 ♀: Gladwyn, Penna., VI, 7, 1908; (S. G. Dixon); 1 ♀: Atlanta, Georgia; VIII, 28, 1912; 1 ♀: Excelsior Springs, Missouri; 1 ♀: Douglas County, Kansas; 1 ♂, 1 ♀.

[17] Tuckerton, New Jersey, IX, 1907, (F. Austin), 1 ♀.

[18] Ann. Soc. Entom. France, 1912, p. 401, (1912).

**Gryllotalpa intermedia** Saussure

1874. *Gryllotalpa intermedia* Saussure, Miss. Sci. Mexiq., Rech. Zool., vi, pp. 341, 345. [Hot lands of the Gulf Coast of Mexico; Central America.]

Manaos, Amazonas. (Mann and Baker.) One male.

Concha Huaya, Rio Ucayali, Peru. January 7 to 10, 1913. Two females.

Contamano, Rio Ucayali, Peru. October to December, 1912. Five males, seven females.

Rio Pacaya, Peru. July, 1912. Seven males, five females.

The series referred to *intermedia* fully agrees with the brief original description and the line or so of additional information given later by the original author. We have been able to study a single male of this species from Port Limon, Costa Rica, from the collection of the United States National Museum (Fred. Knab), and, aside from the features here mentioned, the Amazonian series agrees with the Costa Rican specimen. The latter is smaller than the majority of the Brazilian or Peruvian material, being very close to the original measurements, while the wings are briefly caudate, just reaching to the base of the disto-dorsal abdominal segment. All the present South American series are elongate caudate in wing development, these much surpassing the apex of the abdomen, while the ocelli are much smaller, proportionately as well as relatively, in the Port Limon individual than in the others. The wing length features are clearly as individual in this species as the same conditions are in *G. hexadactyla* and other species of this subfamily, while the ocellar size difference is probably geographic or has a physiologic correlation, similar variation being known in *hexadactyla*. The specimens before us show that the development of the double series of chaetiform hairs on the disto-dorsal abdominal segments is correlated, as mentioned above under *hexadactyla*, with the wing length. The relatively short-winged Port Limon specimen has these subobsolete, while the remaining long-winged individuals have them distinctly developed.

The species is distinctly smaller and more slender than *hexadactyla*, with shorter digits on the cephalic tibiae. The form shows considerable individual size variation, which is not sex correlated, although the very smallest individuals seen are males. However, some of the largest specimens are also males, while certain females

are quite small. The smallest and one of the largest specimens from Contamano, as well as the Port Limon individual, measure (in millimeters) as follows:

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Length of wing distad of tegmen | Length of caudal femur |
|---|---|---|---|---|---|---|
| ♂ Port Limon, Costa Rica | 19 | 6.2 | 4.5 | 7 | 3.6 | 5.2 |
| ♂ Contamano, Peru | 19.1 | 5.1 | 4 | 7.3 | 11.8 | 4.8 |
| ♀ Contamano, Peru | 25.4 | 6.7 | 5.1 | 9 | 13.5 | 6.4 |

In none of the present series do the tegmina reach to the apices of the caudal femora. As far as the present relatively extensive series is concerned, we find no tendency toward the spination of the dorso-internal margin of the caudal tibiae, such as has been noted in *G. hexadactyla*.

**GRYLLOTALPELLA** new genus

Related to *Gryllotalpa* Latreille, from which it can be readily distinguished by the auditory foramina of the cephalic tibiae being open and sub-reniform, while in *Gryllotalpa* they are rimate, occasionally the slit having a slight overhanging and covering projection. In *Gryllotalpella* the ventro-caudal margin of the cephalic femora are unexpanded and simple, while in *Gryllotalpa* this margin is lamellate expanded. The tegminal venation of *Gryllotalpella* is much more simple, with almost no proximal cross-veins, than in *Gryllotalpa*, which has numerous cross-veins in the same section. The form in *Gryllotalpella* is also much more slender and the size smaller than in the species of *Gryllotalpa*.

*Generic Characters*—Form slender, its general development Gryllotalpoid. Head narrow; eyes large, closely placed. Pronotum sub-rhombiform, greatest width cephalad of the middle. Tegmina with venation showing few cross-veins, these largely distad; marginal field with reduced proximal section. Cephalic femora with ventral margins carinate, non-lamellate: trochanterial process distinct, trigonal: cephalic tibiae with auditory foramina exposed, subreniform, with margins cingulate and membrane complete; digits four in number: cephalic metatarsi as in *Gryllotalpa*. Caudal tibiae armed at apex with six spines.[19]

[19] If *Gryllotalpa macilenta* Saussure is found to be a member of this genus, as appears quite probable, this sentence will require modification, as it is said to have but four spines in this position.

Genotype: *Gryllotalpa minor* Bruner.

The genus probably includes *Gryllotalpa macilenta* Saussure,[20] from Surinam, but no material is available for comparison. Its general form, however, is close to that of the genotype of *Gryllotalpella*, and the general form of the cephalic femora is figured as similar.

**Gryllotalpella minor** (Bruner)

1916. *Gryllotalpa minor* Bruner, Ann. Carneg. Mus., x, pp. 349, 350. ["Between the farm Berlin and Guaja Mirim," Rio Mamoré, Bolivia.]

Manaos, Amazonas. (Mann and Baker.) One female.

This specimen is slightly larger than the type and has distinctly longer tegmina and fully developed caudate wings, which surpass the apex of the abdomen by more than half of the pronotal length. The measurements (in millimeters) are as follows: length of body, 19.6; length of pronotum, 6; greatest width of pronotum, 4.2; length of tegmen, 8.1; length of wings distad of tegmina, 11.1; length of caudal femur, 4.5.

**Scapteriscus oxydactyla** (Perty)

1832. *Gryllotalpa oxydactyla* Perty, Delect. Anim. Artic. Brasil., p. 118, pl. 23, fig. 7. [Interior of Minas Geraës, Brazil.]

Rio Madeira, five hundred miles from mouth. (Mann and Baker.) Two females, twenty-one immature specimens.

Upper Beni River, Bolivia. (Dr. Heath, through E. D. Cope.) One male.

Contamano, Rio Ucayali, Peru. October to December, 1912. One female.

The immature specimens represent at least three instars preceding maturity and in all the distinctive color pattern of the species is clearly indicated. These undeveloped individuals also show the progressive production of the dorsal thickening of the cephalic tibiae into a decurved lamellation, which in the mature condition and preceding instar cover over the auditory foramina, which in the least developed specimen are almost completely exposed reniform tympana.

The range of the species extends from at least as far north as the Amazon Valley, south to Rosario, Argentina (Bruner), and from Rio Grande do Sul and Minas Geraës, west to the upper reaches of the Amazonian system in Peru (Contamano) and Bolivia (upper Beni).

[20] Miss. Scient. Mexiq., Rech. Zool., vi, p. 343, pl. viii, figs. 23, 23a, (1874).

**Scapteriscus tenuis** Scudder

1869. *Scapteriscus tenuis* Scudder, Mem. Peabody Acad. Sci., i, pp. 7 and 8, pl. i, fig. 7. [Puty, State of Piauhy, Brazil.]

Pará, Pará. (C. F. Baker.) One female.

Pará, Pará. (W. M. Mann.) One female.

Ceará, Ceará. (W. M. Mann.) One male.

Natal, Rio Grande do Norte. (W. M. Mann.) One immature specimen.

Baixa Verde, Rio Grande do Norte. (W. M. Mann.) Two immature specimens.

Independencia, Rio Grande do Norte. (Mann and Heath.) One male, five females.

The literature furnishes us with but slight information regarding this interesting little species, which as far as known occurs only in northeastern Brazil, the most eastern (Natal) and most western (Pará) records being given above. The form of the trochanter and the position of the dactyls, combined with the rather pronounced coloration, are distinctive features of the species. The present series of adults are equal to or very slightly larger than the original measurements, and in the same the wings are invariably caudate, appreciably surpassing the apex of the abdomen.

**Scapteriscus borellii** Giglio-Tos

1894. *S[capteriscus] borellii* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Torino, ix, no. 184, p. 45, pl. figs. 12 and 15. [Colonia Risso, Rio Apa, Paraguay.]

Ceará, Ceará. (W. M. Mann.) One male.

Natal, Rio Grande do Norte. (W. M. Mann.) Two males.

Independencia, Parahyba. (Mann and Heath.) One female.

The occurrence of this species in northeastern Brazil is, to say the least, rather surprising, but comparisons of the present material with the original description, and material of both sexes from Argentina (Jujuy, Chacras de Coria and Mendoza), show the Brazilian specimens to be inseparable from the more austral individuals. No previous records from localities to the northeast of the Misiones, Argentina and the Rio Apa, Paraguay, were known.

This species is closely related to *S. mexicanus* (Burmeister) and *acletus* Rehn and Hebard, while *tenuis* is, in general, more nearly

allied to *oxydactyla* (Perty) and *camerani* Giglio-Tos a closer relative of *didactylus* (Latreille).

**Scapteriscus camerani** Giglio-Tos

1894. *Scapteriscus camerani* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Torino, ix, no. 184, p. 45. [Province of San Pedro and Asuncion, Paraguay.]

Rio Madeira, five hundred miles from mouth. (Mann and Baker.) One male.

Amazon, one hundred knots west of Santarem. (Mann and Baker.) Two males, two females.

These specimens have been carefully compared with a male of this species from Buenos Aires, Argentina, previously reported by us,[21] and we find they represent the same species. It is a close relative of *didactylus*, but can be distinguished with ease by its broader and shorter head, which has the eyes slightly less prominent, and by the broader pronotum, the caudal margin of which is more broadly rounded and less produced arcuate. The character of the trochanterial process also assists in the determination, but the head form is the most striking feature.

The species has been recorded from Gualaquiza and Valle del Santiago, eastern Ecuador, and it is quite evident from the records now known that its distribution is quite extensive, covering at least a considerable portion of the upper and middle Amazonian regions, in addition to reaching as far to the south as Buenos Aires.

**Scapteriscus vicinus** Scudder

1869. *Scapteriscus vicinus* Scudder, Mem. Peabody Acad. Sci., i, pp. 7 and 12, pl. i, figs. 4 and 23. [Rio Negro; Piauhy and Pará, Brazil; Panama; Rio Grande (Brazil?); Asia?]

Quibdo, Cauca, Colombia. September, 1896. One female.

Caicara, Venezuela. July 9, 1907. (G. K. Cherrie.) Six males, seven females. [A. N. S. P. and Hebard Cln.]

Rio Pacaya, Peru. July, 1912. One female.

We have been able to compare these specimens with the single male from Rio Negro (received from P. R. Uhler) which stands at the head of the list of specimens in the original description, and which is here selected as the lectotype. This individual demonstrates that Rehn and Hebard have correctly interpreted the species in their study of material from North America.

[21] Proc. Acad. Nat. Sci. Phila., 1915, p. 289, (1915).

The species is now known to range as far south as Las Palmas, Chaco, Argentina and Santa Cruz de la Sierra and Puerto Suarez, Bolivia, west to the Rio Pacaya, Peru, east to Piauhy, Brazil and north to Colombia and Venezuela, and through the West Indies, occurring also in eastern Georgia.

**Tridactylus apicialis** Say

1825. *T[ridactylus] apicialis* Say, Journ. Acad. Nat. Sci. Phila., iv, p. 310. ["St. John's River, in east Florida and on the Missouri, as far as Council Bluff."]

Igarapé-assú, Pará. (H. S. Parish.) One female.

Rio Madeira, five hundred miles from mouth. (Mann and Heath.) Twelve males, ten females, seven immature males, one immature female.

These specimens have been the object of a considerable amount of comparison and tabulation, with consideration from different view-points of the problems they present. The conclusions reached are best presented serially. The first important point is that the Igarapé-assú female is absolutely indistinguishable from average North American specimens of that sex. The next is that the Rio Madeira series, which has been dried from alcohol and consequently has its coloration affected and doubtless has shrivelled to a certain degree, as a whole is appreciably smaller than North American specimens of the species. The third is that the metatarsi of the caudal limbs average longer, in proportion to the principal spurs, in the Rio Madeira individuals than in North American specimens. The fourth, instability in genital features, generally used diagnostically, is proven by the series now available for study.

We will discuss the last three of these conclusions as briefly as possible. Relative to size, it is evident from the examination of series from North American localities that size variation is decided. It is known to be individual and probably is, to a certain degree, geographic. The present Rio Madeira series was doubtless taken in a circumscribed area and the individuals were in all probability subject to identical control influences. These specimens have also been dried from alcohol, a process almost invariably productive of some shrinkage. The Igarapé-assú female is of similar size to the average of North American material.

Examination of a considerable number of specimens from both Americas shows the larger distal tibial spurs and the metatarsus of the caudal tarsi vary in length, relatively as well as actually.[22] We find in an extensive series from Spring Creek, Georgia, and a smaller lot from West Point, Nebraska, that the spurs range from equal to slightly longer than the metatarsus, while in the Rio Madeira material the spurs average faintly shorter than the metatarsus. We have seen one North American specimen[23] with the spurs shorter than the metatarsus. Shrivelling may have exaggerated the shortness of the spurs in the Rio Madeira specimens, as they show the pull of drying by having a somewhat arcuate form. Relative to the form of the free margin of the ultimate and penultimate ventral abdominal segments of both sexes, we find most decided variation. In the male sex the more usual type in North American specimens has the penultimate segment with a straight margin, the ultimate very faintly and shallowly arcuato-emarginate; from this type we find modifications with the penultimate segment having the margin flattened arcuate to very shallowly concave, the ultimate more deeply concave to almost truncate. The same sex in the Rio Madeira specimens always has the penultimate segment with a more or less arcuate margin, and the ultimate segment ranging from no more concavo-emarginate than in Spring Creek males, to deeply arcuato-emarginate, in fact sub-bilobate, with the lateral portions of the segment subcompressed. This latter condition is apparently due to the drying from alcohol, the degree of which it is almost impossible to correctly estimate. In the female sex the penultimate segment has the margin, in the Spring Creek series, varying from subtruncate with the faintest sort of nick mesad, to broadly and shallowly obtuse-angulate emarginate (more usual), while the ultimate segment has the margin truncate or truncate with a minute indentation, to faintly concave (more usual). The Rio Madeira females, from having the extreme type with a broad truncate emargination of the penultimate

[22] One male from West Point, Nebraska, in the Hebard Collection, has the metatarsi of the caudal limbs aborted, being represented by mere excrescences, such as found in the related genus *Ellipes*.

[23] Maryland; one male; (A. N. S. P.).

segment and a regularly arcuato-truncate ultimate segment, range to types as described from the Spring Creek representation.

It is evident from these summaries that the size difference is not of specific value, while the proportion of spurs and metatarsus is variable, and the form of the margins of the penultimate and ultimate ventral abdominal segments not of specific diagnostic value in the present instance.

In coloration all the Rio Madeira specimens are of the pale type, but this is certainly due in large part to the action of alcohol. The Igarapé-assú female is a relatively dark specimen.

Of the four species of the genus recently described by Bruner from South America,[24] the Rio Madeira material shows some approach to his *atratus*, but we cannot consider this as distinct from *apicialis* after the examinations we have made, nor can we make *atratus* synonymous without more data than that contained in the description.

Brunner[25] has recorded this species from Buenos Aires and the Misiones, Argentina, Giglio-Tos[26] reported it, with a query, as the synonymous *mixtus* from Urucum, southern Matto Grosso, Brazil, while Scudder has quoted Bolivar as reporting it from Ecuador.

**Ellipes minuta** Scudder

1862. *T[ridactylus] minutus* Scudder, Boston Journ. Nat. Hist., vii, p. 425. [Southern Illinois.]

Pará, Pará. (C. F. Baker.) One female.

[24] It is most unfortunate at this date, and in the state of our knowledge of the instability of the features of the cephalic tibiae in this genus, and also of the tone of coloration, which any large series shows to be unimportant, to find "new" species based largely on these features. In the Gryllidae, more so than in any other group of Orthoptera, it is of the utmost importance for the describer to secure a proper conception of variation within species, and also to keep in close touch with the recent quantitative and variational studies of the group treated. This does not seem to have been done in Bruner's paper on South American Crickets (Ann. Carneg. Mus., x, pp. 344 to 428, (1916) ), as considerable of the recent work on the genera *Nemobius*, *Gryllus*, *Miogryllus*, *Neoxabea*, *Cyrtoxipha* and *Anaxipha* has been overlooked or disregarded, while morphological features, such as the perforation of the cephalic tibiae in *Miogryllus*, *Gryllodes*, *Anaxipha* and *Cyrtoxipha*, which have been tested out and found wanting as diagnostic specific characters, still appear as of prime importance.

[25] Ann. Mus. Civ. Stor. Nat. Genova, xxxiii, p. 195, (1893).

[26] Bollett. Mus. Zool. Anat. Comp. Torino, xv, no. 377, p. 8, (1900).

This specimen is inseparable from material from the United States. We also have specimens (three males) from as far south as Mendoza, Province of Mendoza, Argentina (Haarup), in the collection of the Academy. The species is seen to have a very great distributional range, being in the class with *Gryllus assimilis* and *Miogryllus verticalis*.[27] The Pará and Mendoza specimens are all macropterous.

**Ripipteryx pulicaria** Saussure

1896. *Rhipipteryx pulicaria* Saussure, Biol. Cent.-Amer., Orth., i, p. 215, pl. xi, fig. 24. [Dos Caminos, Guerrero; Atoyac, Vera Cruz and Teapa, Tabasco, Mexico.]

Pará, Pará. (C. F. Baker.) One female.

We have compared this specimen with material from Belize, British Honduras (one male), San Marcos, Nicaragua (one female) and Trinidad (two males), in the collection of the Academy, and find them to be specifically inseparable. As Bruner has stated[28] there is quite a wide range of variation in specimens, so far as color is concerned and to a certain degree in size. The antennal coloration is one of the markedly variable features, and in the Pará specimen the antennae are fuscous, with the proximal segments marked dorsad and the median segments disto-dorsad with yellowish.

The species has been recorded from as far south as Corumbá, Matto Grosso, and Jacoré, Minas Geraës, Brazil, and Puerto Suarez, Bolivia, west to Tarma, Peru, east to Trinidad and French Guiana (Nouveau-Chantier).

**Ripipteryx trilobata** Saussure

1874. *Rhipipteryx trilobata* Saussure, Miss. Scient. Mexiq., Rech. Zool., vi, p. 357. [Guiana.]

Pará, Pará. (W. M. Mann.) Two males.

Porto Velho, Rio Madeira. (Mann and Baker.) One female.

[27] Bruner (Ann. Carneg. Mus., x, p. 359, (1916) ) has continued to use *histrio* and *histrionicus* Saussure as valid specific names, although they were synonymized under *minuta* by Scudder as long ago as 1902 (Psyche, ix, p. 308). Rehn and Hebard recently have made some remarks (Proc. Acad. Nat. Sci. Phila., 1916, p. 284, (1916) ) concerning the variability of *minuta*, chiefly in reference to the presence or absence of subapical natatory lamellae on the dorsal margins of the caudal tibiae.

[28] Ann. Carneg. Mus., x, p. 367, (1916).

These specimens are inseparable from a male of the species from Demerara. Bruner has recorded the species from Pará, and Chopard reported it from St. Jean du Maroni and Nouveau-Chantier, French Guiana, but the distribution is considerably extended by the Porto Velho individual.

GRYLLINAE

**Hemigryllus ortonii** (Scudder)

1869. *Nemobius ortonii* Scudder, Proc. Boston Soc. Nat. Hist., xii, p. 330. [Napo or Marañon (Rivers).]

1877. *H[emigryllus] kreichbaumeri* Saussure, Mélang. Orthopt., ii, fasc. v, p. 268, pl. 12, fig. viii. [Brazil.]

Independencia, Parahyba. (Mann and Heath.) One female.

Itacoatiara, Amazonas. (Mann and Baker.) One female.

Rio Madeira, five hundred miles from mouth. (Mann and Baker.) Two males, four females.

Madeira-Mamoré Railroad Camp 39, Rio Madeira. (Mann and Baker.) One male.

Madeira-Mamoré Railroad Camp 41, Rio Madeira. (Mann and Baker.) One male.

We have now before us the unique female type of Scudder's *Nemobius ortonii*, which represents the insect on which Saussure eight years later erected the genus and species *Hemigryllus kreichbaumeri*. The type is somewhat discolored and considerably shrivelled and distorted, but the synonymy of the two names is beyond question.

The Independencia specimen is distinctly paler than any of the other individuals of the species here recorded, the darker pattern being weaker, more broken and less continuous, as well as the ground color paler, than in the other more intensively colored specimens. The Madeira series shows some variation in size, but not sufficient to cause any difficulty in the recognition of the species.

The species has been recorded from as far south as Santa Rosa, Province of Salta, Argentina (Giglio-Tos), east to Independencia, Parahyba, Brazil, west to the Rio Napo, Ecuador (Bolivar).

**Anurogryllus muticus** (DeGeer)[29]

1773. *Gryllus muticus* DeGeer, Mém. Hist. Ins., iii, p. 520, pl. 43, fig. 2. [Surinam.]

Independencia, Parahyba. (Mann and Heath.) Three females.

These specimens have been compared with two topotypic females (Paramaribo, Surinam; K. Mayo), in the collection of the Academy, and no differences worthy of mention seen.

The species is widely distributed in South America, extending south to Argentina and west to eastern Peru and Ecuador, reaching as high as five thousand feet elevation in Peru (Huadquina; Caudell).

**Miogryllus convolutus** (Johannson)

1763. *Gryllus convolutus* Johannson, Amoen. Acad., vi, p. 399. [Surinam.]

Manaos, Amazonas. (Mann and Baker.) Two males.

Porto Velho, Rio Madeira. (Mann and Baker.) One male.

These specimens have been recorded by Hebard in his study of the genus.[30]

**Miogryllus verticalis** (Serville)[31]

1839. *Gryllus verticalis* Serville, Hist. Nat. Ins., Orth., p. 343. [Cayenne.]

Baturite Mountains, Ceará. (W. M. Mann.) One male.

Maranguape Mountains, Ceará. (W. M. Mann.) One male.

Independencia, Parahyba. (Mann and Heath.) One male, one female.

These specimens have been recorded by Hebard in a study of the genus.[32]

**Gryllus assimilis** (Fabricius)

1775. [*Acheta*] *assimilis* Fabricius, Syst. Entom., p. 280. [Jamaica.]

Ceará, Ceará. (W. M. Mann.) One male, one female.

Natal, Rio Grande do Norte. (W. M. Mann.) One female.

[29] Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1916, pp. 291 and 292, (1916) ) have made important critical notes on the synonymy of this species.

[30] Journ. N. Y. Entom. Soc., xxiii, pp. 109 to 110, (1915).

[31] There can be little question but that Bruner's recently described *Gryllodes macropterus*, based on a single male from the State of Bahia, Brazil, and *Gryllodes argentinus*, described from four specimens from Carcarañia, Argentina, were founded on macropterous individuals of this very variable and widely distributed species. For comments on this genus and species, see Hebard (Journ. N. Y. Entom. Soc., xxiii, pp. 101 to 121, (1915) ).

[32] Journ. N. Y. Entom. Soc., xxiii, p. 121, (1915).

Independencia, Parahyba. (Mann and Heath.) Three males.

For critical comments on this very plastic and widely ranging species see Rehn and Hebard's recent paper on the American *Gryllus*.[33]

The descriptive symbols proposed by the above authors, would read for these specimens as follows: Ceará; ♂, D Y e x 4; ♀, C D? e v O 3. Natal: ♀, C D Y e v 3. Independencia: ♂, A X c x O 3; ♂, A W a x O 3; ♂, A X c v O 3. The Ceará and Natal specimens have distinct head stripes and apparently show in all a response to the subarid character of the region.

OECANTHINAE

**Paragryllus temulentus** Saussure

1878. *P[aragryllus] temulentus* Saussure, Mélang. Orthopt., II, fasc. vi, p. 553. [Brazil.]

Porto Velho, Rio Madeira. (Mann and Baker.) One female.

We have examined, with this specimen, two males from Bartica, British Guiana (XII, 12, 1912; H. S. Parish), in the collection of the Academy. It seems probable that the Central American material referred to this species by Saussure, in 1897,[34] represented a different species from the type, which had passed out of his hands before that time. At all events the present material accords better with his original description than it does with his later one, based on Central American specimens.

**Oecanthus tenuis** Walker

1869. *Oecanthus tenuis* Walker, Catal. Derm. Salt. Brit. Mus., p. 95. [Santarem, Brazil.]

Independencia, Parahyba. (Mann and Heath.). Two females.

These specimens are referred to *tenuis*, although the eyes are not piceous, as described. The material in hand, however, has been strongly decolored by immersion in a liquid preservative, and the present coloration of the eyes is the greenish white of the whole insect. The proximal and second antennal joints are finely lineolate with black on their ventral face, that of the proximal joint occasionally broken mesad, and that of the second joint faintly arcuate. The proximal joint is distinctly bullate on the ventro-internal face.

[33] Proc. Acad. Nat. Sci. Phila., 1915, pp. 293 to 322, pl. iv, (1915).

[34] Biol. Cent.-Amer., Orth., I, p. 242, pl. xii, figs. 2 to 7.

**Oecanthus pictipes** new species (Plate III, figs. 19, 20 and 21.)

A very striking and distinct species of the genus, which differs, at least from all the previously known American forms, in the distinctly and rather closely punctulate limbs, the annulate antennae and the paired dark postocular lines on the head, while the small size, the structure and pattern of the two proximal antennal segments, the short and broad pronotum and the greatly aborted wings will assist in the recognition of the species.

Type.—♂; Natal, State of Rio Grande do Norte, Brazil. (Stanford Brazilian Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila., Type no. 5330.]

Size very small: form as usual in the genus. Head moderately elongate, subdepressed; interocular region with an impressed, transverse, obtuse-angulate sulcation, the arms of the angle weakly arcuate; inter-antennal section moderately elongate, subequal in width, moderately bullate: palpi with the third and fourth joint subequal in length, the fifth joint longer than either of these, slender, cylindrico-fusiform: eyes moderately prominent, acute pyriform in basal outline: antennae with the proximal joint relative large, subdepressed, internal face with a distinct bulbous swelling. Pronotum relatively short, the greatest length but slightly greater than the caudal width, when seen from the side the dorsal line is straight; the disk broadly rounds laterad into the lateral lobes; cephalic margin of the disk moderately arcuate, caudal margin of same bisinuate-truncate: surface of the disk smooth cephalad, in caudal half with a distinct, but short, medio-longitudinal impression, laterad of which are faintly more decided, equally long, but arcuate impressions, the curve of the arcuation laterad; when seen from the dorsum the pronotum is appreciably constricted very shortly cephalad of the caudal margin: lateral lobes of the pronotum distinctly longer than deep, the greatest depth at the caudal third, near which point the pinching-in of the lobes is most decided; ventro-cephalic angle of the lobe hardly indicated, broadly arcuate-obtuse; ventral margin oblique, regularly arcuate; ventro-caudal angle broadly rounded rectangulate. Tegmina of medium width, the greatest breadth of the dorsal field contained about twice in the greatest length of the same: lateral field broad, strongly reflexed ventro-mesad, the greatest width of the field at the distal third; costal margin in general straight except for very brief proximal and much more extensive distal arcuations; mediastine vein with eight rami, these remote distad and rather crowded proximad, the distal ones sigmoid, the proximal ones more simple arcuate oblique; humeral vein following closely the curve and position of the mediastine vein, the area separating the two very narrow, at about the distal fourth the humeral vein is obtuse-angulate, from whence it follows, at a greater distance than elsewhere, the oblique tendency of the mediastine vein, the point of angulation connected with the discoidal vein by a very short cross nervure; discoidal vein separated from the humeral vein by a relatively broad area, the vein straight

in the proximal two-thirds, but arcuate towards the costal margin in the distal third, obtuse-angulate at the connecting nervure, the short remaining section of the vein directed towards the median vein, which latter is in general straight; stridulating vein broadly rectangulate-arcuate; axillary veins three in number; oblique veins three in number, one complete and two anastomosed with a sinuate accessory longitudinal nervure; diagonal vein straight, oblique; speculum crudely semi-elliptical in shape, obliquely straight delimited proximo-suturad, with a single transverse vein; postaxillary veins three in number, the median one slightly less distinct than the others and strongly sinuate, the sutural one of the postaxillary veins continuing around the speculum in a regular arcuation. Wings aborted. Cephalic femora slender: cephalic tibiae faintly exceeding the femora in length, slender, weakly expanded about the tympanum, which is elongate elliptical perforate on both faces. Caudal femur moderately robust; appreciably tapering distad: caudal tibiae faintly surpassing the femora in length: caudal metatarsi faintly more than twice as long as the dorso-internal distal spur of the tibiae.

General color antimony yellow, the head strongly washed with vinaceous-rufous.[35] Surface of the pronotum with numerous points of rufous, the limbs rather thickly punctulate with prout's brown, on the caudal femora disposed somewhat in the form of short, oblique dashes; caudal tibiae with the smaller spines chiefly and the larger spines apically fuscous. Eyes dresden brown: antennae in the intensive condition with the proximal joint inclined towards naples yellow, with the bullation bearing a longitudinal black figure, which resembles a reversed, robust exclamation mark, but the two sections are connected, mesad of which, at the very base, the segment bears a small black dot; second joint with a transverse, roughly L-shaped, black figure, external face with a faint black dot; remaining antennal segments incompletely and narrowly annulate with fuscous, every two to three segments with the annulation more pronounced and more nearly complete: recessive condition (the type approaching this phase) with the proximal and second antennal joints less strongly marked, although the pattern is evident and the weaker, incomplete annuli of the remaining antennal segments are obsolete or subobsolete. Head with a pair of short, closely placed, postocular fuscous lines.

Length of body, 7.3 mm.; length of pronotum, 1.5; greatest width of pronotum, 1.6; length of tegmen, 7.2; greatest width of dorsal field of tegmen, 3.5; length of caudal femur, 5.

In addition to the type we have before us four paratypic males, two topotypic, and two from Misiones, Argentina (December; P. Jorgensen), all in the collection of the Academy. All of the males of the species examined are in poor condition, either broken or with the color altered, or both, so we are able to give no important comments on individual differences. No features

[35] The type is the only specimen seen having the head washed as described above, which condition may be due to discoloration, but it is so uniform and regular it seems best to describe it.

of noteworthy importance, however, appear, aside from those mentioned in the above description. The species is so sharply characterized no difficulty should be encountered in its recognition.

ENEOPTERINAE

**Eneoptera surinamensis** (DeGeer)

1773. *Gryllus surinamensis* DeGeer, Mém. Hist. Ins., iii, p. 519, pl. 43, fig. 1. [Surinam.]

Peixe Boi, east of Pará, Pará. November to December, 1907. (H. B. Merrill.) Two males, four females, six immature specimens.

Pará, Pará. (W. M. Mann.) Three males, two females. (C. F. Baker.) Five males, three females.

Manaos, Amazonas. (Mann and Baker.) One male.

Porto Velho, Rio Madeira. (Mann and Baker.) One female.

This series shows the great degree of variation in size and coloration so characteristic of this species. The most striking color feature seen in this series, aside from the shining blackish or dark brownish of the face and the lateral lobes of the pronotum, is the coloring of the dorsal surface of the head, pronotum and dorsal surface of the caudal femora with dull zinc orange. This condition is found in two males and one female from Pará. One Pará male and one female from the same locality are quite uniformly blackish. Two of the Peixe Boi females are more uniformly mummy brown than the average from that or the other localities. The size variation in the Peixe Boi series is as decided as in the remainder of the above recorded representation.

**Paroecanthus roosevelti** new species (Plate III, figs. 22, 23, 24, 25 and 26.)

This is a very distinct species of the genus, forming with another at present undescribed species, and probably *P. picipes* Bruner, a readily recognized section of the genus. The present insect needs no detailed comparison with the previously known species excepting *picipes*, as its distinctive livery—the dorsum of the head and pronotum being rufescent, the postocular region of the head, the lateral lobes of the pronotum, a spot at the base of the tegmina and all of the limbs, aside from the pale buffy proximal section of the median femora and the similarly colored ventro-proximal

section of the caudal femora, being black—will immediately distinguish it. Bruner's recently described *P. picipes*,[36] from Quatro Ojos, Department of Santa Cruz, Bolivia, apparently differs from our species in its distinctly larger size, in the lack of color contrast on the head and pronotum, and doubtless other features not mentioned in the lengthy, but inconclusive, description of *picipes*.

Type.—♂; Bartica, British Guiana. March 24, 1913. (H. S. Parish.) [Acad. Nat. Sci. Phila., Type no. 5331.]

Size small (for the genus): form moderately depressed: surface moderately velutinous. Head subvertical, no wider than the extreme cephalic width of the pronotum, general form of the cephalic aspect of the head broad ovoid, narrowing ventrad: occiput strongly declivent to the subvertical rostrum, which latter is much narrowed between the antennae, its least width not half that of the proximal antennal joint, faintly sulcate: median ocellus not apparent; lateral ocelli large, subovate, placed at the caudal angle of the antennal scrobes and separated from the eyes by less than the short diameter of the ocelli: palpi short, the third joint faintly longer than the fourth, robust; fourth joint enlarging distad; fifth joint very broad and short, subconical, the distal margin subarcuate truncate, the extensor margin arcuate: eyes in basal outline pyriform-ovoid, caudo-ventral margin slightly flattened, when seen from the dorsum the eyes are moderately prominent: antennae considerably surpassing the body in length; the proximal joint large, depressed, dorsal face naked proximad and clothed with hairs distad and on the internal face. Pronotum with the disk regularly expanding caudad, the caudal width of the same subequal to the median length; cephalic margin of the disk gently concave, caudal margin weakly bisinuate, mesad broadly but shallowly arcuate, all margins cingulate; pyriform impressions distinct: lateral lobes distinctly longitudinal, the ventral margin regularly arcuate, ventro-cephalic angle rather narrowly rounded, ventro-caudal angle broadly rounded; surface of the lobes with a dorso-median impressed area, another ventro-cephalad and a third close to the ventro-caudal angle. Tegmina surpassing the apex of the abdomen, also of the caudal femora by more than the length of the pronotum, the greatest width of the dorsal field contained three times in the length of the tegmina, lateral margins of the dorsal fields of the closed tegmina subparallel mesad: costal margin of the usual form found in the genus; marginal field increasing in width to the distal fourth; mediastine vein with twelve sigmoid rami, the proximal section of the marginal field also with four free veins; humeral vein closely paralleling the mediastine vein, distinctly obtuse-angulate at the distal fourth; discoidal vein straighter than the humeral vein mesad, arcuately approaching the same distad; median vein straight; stridulating vein strongly bisigmoid, the proximal bend practically V-shaped; axillary veins four in number, the third (from costal margin) most prominent; anal node prominent; oblique veins six in number, strongly sinuate oblique;

[36] Ann. Carneg. Mus., x, p. 422, (1916).

diagonal vein prominent; postaxillary veins three in number, two moderately sigmoid, one arcuate; speculum with its length (oblique) slightly greater than the width, the proximal outline rounded obtuse-angulate, costal outline similar, section toward the sutural margin arcuate, distal arcuation with a rounded disto-costal rectangulation, the speculum with a single cross-vein; distal area with three rami of the median vein. Wings projecting distad of the closed tegmina a distance equal to one and one-half times the length of the pronotum. Cerci falling slightly short of the tips of the closed wings: subgenital plate subcompressed distad, caudal aspect of the same with the margin U-shaped mesad. Limbs rather robust. Cephalic tibiae fusiform, considerably inflated mesad, more slender distad than proximad: cephalic face of the cephalic tibiae with a narrow, linear foraminal opening, the caudal face with a semiovate tympanum, the straight portion of the outline of which is flexor in position: cephalic tarsi very short. Caudal femora not two-thirds as long as the tegmina, rather regularly tapering, the distal extremity relatively slender: caudal tibiae armed distad on both margins with four major spines: caudal metatarsi short, the dorsal length but little more than the length of the dorso-internal distal spur of the tibiae, the dorsal margins of the metatarsi armed with one (internal) or two (external) spines.

Allotype.—♀; Madeira-Mamoré Railroad Company Camp 39, Rio Madeira, Brazil. (Stanford Brazilian Expedition; Mann and Baker.) [Acad. Nat. Sci. Phila.]

The following features are those of difference from the description of the male (type). Lateral ocelli slightly smaller than, but of similar form and in similar position to, those of the male sex, separated from the eyes by about the greatest ocellar length. Pronotum slightly more longitudinal than in the male. Tegmina with the greatest width of the dorsal field contained about four and one-half times in the tegminal length; lateral margins of closed dorsal fields parallel in proximal half: mediastine vein with eight oblique rami, six free veins present proximad in the marginal field; humeral vein following the regular curve of the mediastine vein, being connected with the same by means of a number of short cross-veins, which form small, rectangulate areolets; discoidal and median veins simple, faintly sinuate proximad, the median with four oblique distal rami, which form an integral part of the regular dorsal reticulation; ulnar vein triramose, the rami regularly oblique and paralleling the anal and axillary veins and the distal rami of the median vein; the anal vein simple, the axillaries two in number, the whole dorsal venation with quite regularly placed cross-veins, which make rectangulate areolets, these becoming irregular proximad between the ulnar and anal veins.

General color of the dorsal surface of the head and pronotum, burnt sienna; of the dorsal field of the tegmina and the visible portion of the closed wings, ochraceous-buff; lateral lobes of the pronotum, genae and palpi, blackish brown; almost all of the cephalic limbs, greater portion of the median limbs, the distal half of the caudal femora and caudal tibiae and tarsi, fuscous. Ventral surface of thorax and coxae light ochraceous-buff, abdomen ventrad pale

cinnamon-brown, the apex of the abdomen of the male, including the subgenital plate and cerci, fuscous. Ocelli light ochraceous-buff; antennae ochraceous-buff to buckthorn brown, washed with fuscous at proximal third, this area showing sparse, very fine annuli of the base color; eyes clove brown. Lateral field of the tegmina washed with mummy brown to fuscous. Cephalic tibiae touched with bister. Median femora with the proximal two-fifths light ochraceous-buff; median tibiae becoming bister. Caudal femora light ochraceous-buff proximad, the distal half and the dorso-proximal section fuscous. Ovipositor chestnut, narrowly margined laterad with blackish brown.

♂ (*type*). Length of body, 12.5 mm.; length of pronotum, 2.3; greatest (caudal) width of pronotum, 3; length of tegmen, 13; greatest width of tegmen, 4; length of caudal femur, 7.2.

♀ (*allotype*). Length of body, 12.3 mm.; length of pronotum, 2.3; greatest (caudal) width of pronotum, 3; length of tegmen, 13.2; greatest width of tegmen, 3; length of caudal, femur, 7.3; length of ovipositor, 4.6.

The type and allotype are the only specimens of this striking species examined by us.

We take pleasure in dedicating this very interesting form to Theodore Roosevelt, in token of our appreciation of his scholarship as a zoologist and a historian and ability as a statesman. The name Roosevelt long will be associated with the Madeiran region as a result of the work of the Expedicão Scientifica Roosevelt-Rondon.

**Amblyrhethus** [37] **manni** new species (Plate IV. figs. 27, 28, 29, 30, 31 and 32.)

This species agrees with *A. capitatus* (Saussure) in having both faces of the cephalic tibiae provided with foramina, and in the structure of the apex of the ovipositor more closely approximating that species than it does the type found in the other previously known forms. It differs, however, from *capitatus* in its distinctly smaller size, in the slightly narrower fastigium (which is hardly more than twice as broad as the proximal antennal joint), in the form of the lateral lobes of the pronotum, in the more numerous rami of the mediastine vein of the tegmina, in the caudal metatarsi having but two, instead of three, teeth on the dorso-external margin, in the details of the apex of the ovipositor and in certain features of the coloration.

Type.—♂; Independencia, State of Parahyba, Brazil. (Stanford Brazilian Expedition; Mann and Heath.) [Acad. Nat. Sci. Phila., Type no. 5332.]

[37] See Kirby, Synon. Catal. Orth., ii, p. 97, (1906). This name replaced the preoccupied *Amblyopus* Saussure.

Size medium: form subdepressed, as usual in the genus: surface of the head, pronotum, venter, abdomen and limbs largely fine pilose. Head with its width slightly greater than the cephalic width of the pronotum: occiput regularly declivent to the rostrum; fastigium broad, very broadly, faintly and very shallowly excavate between the lateral ocelli: rostrum obtuse-angulate in lateral outline, its interantennal width about one and one-half times as great as that of the proximal antennal joint: median ocellus small, situated at the angle of the rostrum; lateral ocelli relatively large, subovoid, touching the dorsal margin of the antennal scrobes, removed from the eyes a distance equal to the short diameter of the ocellus: eyes unsymmetrical ovato-pyriform in basal outline, when seen from the dorsum moderately prominent, with an extremely faint cephalic trend: antennae about twice as long as the body; proximal joint broad, depressed, pilose distad and along the internal face: palpi with the third joint distinctly longer than the fourth joint and subequal in length to the fifth joint; third joint monili-fusiform; fourth joint conical; fifth joint compressed, subelliptical in outline, the distal margin obliquely subtruncate, internal face deeply and broadly excavate. Pronotum slightly transverse, with the greatest median length contained one and one-third times in the greatest caudal width of the disk: cephalic margin of the disk weakly and shallowly concave, caudal margin weakly bisinuate laterad, mesad broadly arcuate; disk gently expanding caudad, all dorsal pronotal margins rather broadly cingulate; median line of the pronotum with cephalic, slightly premedian and minute postmedian impressions, the disk with cephalic, median and paired lateral impressions: lateral lobes moderately longitudinal; ventral margin of the lobes broadly arcuate, the ventro-cephalic angle rather narrowly rounded, the ventro-caudal very broadly rounded, cingulation very narrow on the ventral margin, exceptionally broad ventro-caudad. Tegmina of the type generally found in males of this group, the greatest width at five-eighths the length from the base and contained faintly more than three times in the length of the tegmen, the closed tegmina with the lateral outlines straight and faintly widening distad to the point of greatest width: marginal field of the type usual in this group; mediastine vein with fifteen to sixteen rami, all oblique and sigmoid, free proximal veins of the marginal field three to four in number; humeral and discoidal veins fusing at distal third, proximad of which they enclose a very elongate lanceolate area, distad they roughly parallel the mediastine vein, but are first more angular and then straighter; median vein practically straight to the speculum, where it is very weakly rounded obtuse-angulate, thence straight, weakly oblique to the apex; stridulating vein with its longitudinal section straight, acute-angulate where it bends transversely, thence arcuate and finally straight, the angle with an incomplete longitudinal spur: oblique veins three in number, the first short, arcuate, joining the stridulating vein close to the angle; the second and third oblique, the second straight, the third weakly sinuate, both fusing in a supplementary node, which is connected with the diagonal vein by a strongly arcuate vein and with the stridulating vein by a shorter, arcuate vein: anal node distinct; anal vein strong, oblique, area between this and the stridulating vein occupied by a sub-longitudinal

bifurcate ramus of the anal vein; axillary vein simple, obtuse-angulate before reaching the anal node; diagonal vein arcuate proximad, thence nearly straight longitudinal to the cephalic angle of the speculum; post-axillary veins three in number, the costal two strongly arcuate, the third very faintly arcuate; speculum with its greatest length (oblique) exceeding the greatest width, obtuse-angulate proximad, single transverse vein arcuate costad; distal area with four arcuate rami, the proximal strongly, the distal weakly so, three generally longitudinal nervures springing from the margin of the speculum toward the sutural margin, the entire area reticulate with irregularly placed cross-veins. Wings surpassing the apex of the tegmina by about half the pronotal length. Cerci reaching almost to the tips of the wings; subgenital plate with a small and weak mesal creasing of the distal margin. Limbs relatively short and moderately robust; third joint of all tarsi relatively long and extremely slender. Cephalic tibiae not enlarged, very faintly tapering in distal half; foramen on cephalic face elliptical, on caudal face similar but faintly larger. Caudal femora robust, the greatest width more than a third of the length, distal extremity relatively slender; caudal tibiae with five external and four internal major spines on the distal half, the spinulations of both margins numbering (reading distad) 2, 2, 1, 0, the last space lacking on the internal margin; external distal spurs with the median nearly twice as long as the dorsal, internal distal spurs with the ventral one half as long as the dorsal one; caudal metatarsi no longer than their internal distal spur; armed on the dorso-external margin with two spinulations, the distal one large, the other small, on the dorso-internal margin with a single large distal one.

Allotype.—♀: Same data as type. [Acad. Nat. Sci. Phila.]

This sex differs from the above description of the male (type) in the following noteworthy features. Lateral ocelli relatively smaller. Pronotum more decidedly transverse, its greatest length contained one and one-half times in the greatest caudal width of the disk. Tegmina distinctly surpassing the apices of the caudal femora, reaching almost to the tips of the cerci and ovipositor, when seen from the dorsum the lateral outlines of the dorsal fields are arcuate distad to the apex; marginal field narrowing regularly in the distal half; mediastine vein with eleven to twelve rami, all oblique and but little sigmoid; humeral and discoidal veins simple, parallel, following the curve of the mediastine vein; median vein with its oblique rami (distad) so fused into the general reticulation of the dorsal field that their origin distinct from the other regular oblique sectors of the field is not readily noticed, the sectors moderately direct but somewhat sinuate, eleven in number including those of median origin, all connected by irregular, rather closely placed, cross-veins, which form areolets of irregular shapes but of clear definition. Caudal tibiae with external margin having a secondary spinulation formula of 3, 3, 1, 0, on internal margin, 3, 3, 2. Ovipositor about four-fifths as long as the caudal femora, deplanate; the apex hardly expanded, rather broadly rounded; dorsal valves distad with numerous transverse, closely placed, sinuate, file-like carinations, the arcuate margin of the same area crenulato-denticulate; ventral valves laterad with two obtuse-angulations, the distal margin arcuate, entire.

Coloration practically destroyed, as almost all the material has been immersed in a liquid preservative. The only evident things are the features of fuscous coloration, which are distributed as follows: points at the median and (not always) the caudo-lateral impressions of the pronotal disk; as a wash for a short distance distad of the three proximal antennal joints, this varying in depth and solidarity; as five spots on the dorsal surface of the caudal tibiae, one proximad, the others roughly between pairs of spines; occasionally a washing on the caudal tarsi; as numerous scattered points on the dorsal field of the tegmina of the male, these points larger in the general vicinity of the ends of the anal node, at the base of the anal vein and about the supplementary node, most numerous and thickly dispersed along the distal margin of the speculum, and as a cloud (in intensive individuals only) crossing the distal area of the same field. It would also seem that the mediastine rami and the veins of the distal area are, in undamaged specimens, thickly ticked with fuscous. In the male the humeral angle, the anal node, anal vein and the supplementary node are strongly opaque yellow. In the female the vicinity of the humeral vein is quadrato-punctate with fuscous dorsad in the proximal half, the lateral field has the veins tinted with yellowish and all the veins of both fields are faintly ticked with fuscous. Ovipositor chestnut, becoming fuscous distad, the sculpture of the valves marked with the same.

♂ (*type*). Length of body, 13 mm.; length of pronotum, 2.6; greatest (caudal) width of pronotum, 3.5; length of tegmen, 15; greatest width of dorsal field of tegmen, 5; length of caudal femur, 7.3.

♀ (*allotype*). Length of body, 13.8 mm.; length of pronotum, 3.1; greatest (caudal) width of pronotum, 4; length of tegmen, 15.5; greatest width of dorsal field of tegmen, 4.4; length of caudal femur, 8; length of ovipositor, 6.1.

In addition to the type and allotype, we have before us four paratypic males from Independencia, bearing the same date as the type and allotype, and another male from Bonito, Pernambuco, Brazil (January 27, 1883; A. Koebele; on cotton), the latter from the U. S. National Museum collection. All of the Independencia specimens have been immersed in a preserving fluid, while the Bonito representative is badly damaged, having no caudal and but a single cephalic limb, and the tegmina partly destroyed. In size the males are quite uniform. The oblique veins of the male tegmina vary in number from three (in the type alone) to six (in one paratype), the ones additional to those described in the type all being small, arcuate and placed proximad of the first one discussed in the above description. The number of rami of the mediastine vein in the males sex varies from fourteen to eighteen, of the free veins of the marginal field from two to four. The number of major spines on the dorsal margins of the caudal tibiae, and of the spinulations on the caudal metatarsi,

are the same in the whole series, except for the presence of five spines on the dorsal internal margin in one paratype, but the intercalated spinulations range from 2, 2, 1, 0 to 3, 3, 1, 0 on the external margin; 3, 2, 1–3, 3, 0–3, 3, 2–2, 2, 1–3, 1, 0, 1 on the internal margin. It is evident from these figures how relatively valueless the spinulation count is as a diagnostic feature.

We take pleasure in dedicating this species to Mr. W. M. Mann, to whose energy the extent of the Stanford Brazilian Expedition insect collection is due.

**Amblyrhethus natalensis** new species (Plate IV, figs. 33, 34, 35, 36 and 37.)

This species has the cephalic tibiae supplied with foramina on both faces, as is the case with *capitatus* and the above described *manni*, but the form of the apex of the ovipositor is more like, yet distinct from, that found in *A. brevipes* and *depressus* (Saussure). The present species differs from all the known forms of the genus, however, in having the dorsal surface of the caudal metatarsi armed on the external margin with three, and the internal margin with two spines.

Type.—♂; Natal, State of Rio Grande do Norte, Brazil. (Stanford Brazilian Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila., Type no. 5333.]

Size medium: form robust, but weakly depressed: surface of body and limbs thickly and closely adpressed pilose. Head broad, moderately depressed, the caudal width of the head subequal to the cephalic width of the pronotum; occiput gently arcuate caudad, moderately declivent cephalad, there distinctly, though broadly, excavate: rostrum rectangulate when seen in lateral outline, its least width subequal to the breadth of the proximal antennal joint, with a distinct, broad and rounded medio-longitudinal sulcus, which is weakly continued to the clypeal suture: ocelli placed in an arcuate line; the median one located at the base of the rostrum in the sulcus, subcircular, of medium size; lateral ocelli subcircular in outline, faintly smaller than the median one, removed from the eyes by hardly more than their own diameter and placed close to the margin of the antennal scrobes: palpi very similar to those of *manni*, described above: eyes very similar to those of *manni*, the ventro-cephalic angle of the basal outline, however, more narrowly rounded: antennae at least two and one-half times as long as the body, subincrassate. Pronotum weakly transverse, the greatest caudal width equal to one and two-thirds times the median length of the same, lateral borders of the dorsum subparallel: cephalic margin of disk distinctly angulato-arcuate emarginate; caudal margin of disk faintly arcuate, almost imperceptibly sinuate in the humeral area; dorsal cephalic and caudal margins broadly cingulate: lateral lobes with their greatest

depth contained one and two-thirds times in the length of the same; margins narrowly cingulate, except caudo-ventrad, where they are, as usual, greatly broadened, ventro-cephalic angle rounded rectangulate, ventral margin straight, ventro-caudal angle broadly rounded. Tegmina surpassing the apex of the abdomen and the tips of the caudal femora by a distance equal to about one-half the dorsal length of the pronotum, broad, the greatest width of the dorsal field, which is at five-eighths the length from the base, contained about two and two-thirds times in the length of the tegmina, lateral margins of the closed dorsal fields of the tegmina subparallel in proximal five-eighths of the tegminal length, the distal portion regularly narrowing thence to the apex: lateral field broad, subequal in depth for the greater portion of its length, narrowing briefly distad: mediastine vein with nine to eleven rami, the distal very faintly, the proximal ones appreciably, sigmoid; free veins at base of the lateral field five to six in number; humeral and discoidal veins of the type of structure found in *A. manni:* stridulating vein of the type found in *manni* but the angle is less decided, hardly more acute than a rectangle: anal and axillary veins of the type found in *manni:* oblique veins five in number, the proximal short, the second and third joined shortly before the junction with the stridulating vein, the second sinuate, the third arcuate, the fourth and fifth nearly straight, slightly divergent, coalescing at the proximal fifth in a supplementary node, the fifth oblique vein strongly and briefly arcuate distad, joining the diagonal vein shortly before the anal node: anal node large: diagonal vein arcuate proximad, straight thence, the latter section nearly longitudinal: postaxillary veins three in number, the sutural one but faintly arcuate, the second bent arcuate, the third moderately arcuate: speculum relatively smaller than in *manni*, in form more circular, its diagonal length but slightly greater than the width, margin of the speculum rectangulate proximad, a single oblique cross-vein present: distal area with four radiating rami of the median vein, the rami with numerous regular cross-veins, these less numerous proximad, more numerous distad. Wings very briefly surpassing the apices of the tegmina. Cerci reaching to the wing-tips, tapering, with a clothing of numerous short hairs and sparse, elongate, scattered hairs: subgenital plate as in *manni*. Limbs very short and robust, almost crab-like when flexed: tarsi with the third joint faintly more robust than in *manni*. Cephalic tibiae with a small, elliptical foramen on the cephalic face, a larger elliptical one on the caudal face. Caudal femora not more than two-thirds as long as the tegmina, very broad, the depth contained about two and one-half times in the greatest length of the femur: caudal tibiae very short, not more than two-thirds as long as the femora; dorsal margins each with four major spines, the intercalated spinulations reading distad 2, 2, 0 on the external margin, the same or 1, 1, 0 on the internal margin; distal tibial spurs much as in *manni*, but the internal ones are slightly more robust: caudal metatarsi slightly more elongate proportionately than in *manni*; dorso-external margin with three, internal with two spinulations.

Allotype.— ♀ ; Same data as type. [Acad. Nat. Sci. Phila.]

The following features are those of difference from the description of the male (type) sex. Size larger than in the male sex. Rostrum faintly broader

than the proximal antennal joint; medio-longitudinal sulcus not apparent on the face ventrad of the rostrum: antennae broken. Pronotum but faintly transverse, with the greatest caudal width equal to one and one-third times the median length of the same: greatest depth of the lateral lobes of the pronotum contained about twice in the greatest length of the same. Greatest width of the dorsal field of the tegmina contained three and two-thirds times in the greatest length of the tegmina, lateral margins of the dorsal fields of the closed tegmina very faintly arcuate: lateral field more regularly narrowing distad than in the male: mediastine vein with six strongly oblique, nearly straight rami; free veins of the lateral field four in number: dorsal field with nine rather regularly disposed, oblique sectors, the median two of which are clearly derived from the ulnar vein, the distal four from the median vein, while the proximal three consist of the anal and two axillary veins: cross-veins rather numerous but frequently irregular, where evenly distributed the areolets are rhombic, an irregular reticulation of venules of less importance is also indicated, this passing into the usually more pronounced cross-veins. Wings very slightly surpassing the apices of the tegmina. Ovipositor slightly more than two-thirds as long as the caudal femora, strongly deplanate, relatively broad; dorsal valves with their apices very regularly narrowing to the bluntly rounded tip, surface obliquely striolate along the oblique external margins, which are in consequence microscopically crenulate, and with very fine similar sculpture, directed, however, in the reverse direction, along the internal margins; ventral valves with their apices having the external margins converging to shortly distad of the middle of the valves, there with a minute rectangulate shoulder, and thence distad subequal, the apex rounded and with extremely delicate, microscopical, marginal crenulations. Cerci in broken condition surpassing the wing tips. Caudal tibiae spined as in the male, except for the dorso-external margin on one limb having five major spines.

General coloration of male light pinkish cinnamon, the tegmina cartridge buff: of the female vinaceous-cinnamon to light vinaceous-cinnamon. The maculations and color features which are ambisexual are the following. A fine punctulation, varying in its exact size and density, of blackish fuscous, present on the head, pronotum, limbs and abdomen. The solid markings or closely grouped sections of punctulations of this shade are: paired lateral double postocular bars, separated by a narrow dividing line of the general color, the bars weaker on the head and stronger on the pronotum, the exact outline of the bars poorly defined and subsinuate; a medio-longitudinal line on the cephalic two-thirds of the pronotum, laterad of which is a faint sublyrate pattern; caudal tibiae with a distinct pregenicular semiannular patch on the dorsal and internal faces; antennae with distant, filiform annuli. Tegmina of male with the postanal section solid blackish fuscous; two blotches of the same dorsad of the base of the humeral trunk, the anal and accessory nodes marked with the same shade; two disto-costal and two proximo-sutural blotches surrounding the speculum, the former grouping much more decided than the latter; the discoidal vein in proximal half with checkings of blackish fuscous; obscure reticulation and rugulosity of the areas and areolets of the dorsal field frosted

with the same color, the impression given being that of shading on a rough surface with a very soft lead-pencil. Tegmina of the female with the blotch at the base of the humeral trunk present, the remainder of the dorsal field mottled with blackish fuscous, the areolets in some cases quite strongly blotched. Ovipositor cinnamon, lined with blackish, the tip washed with mars yellow.

♂ (*type*). Length of body, 12.8 mm.; length of pronotum, 2.6; greatest (caudal) width of pronotum, 3.8; length of tegmen, 11; greatest width of dorsal field of tegmen, 3.8; length of caudal femur, 7.3.

♀ (*allotype*). Length of body, 16.2 mm.; length of pronotum, 3.8; greatest (caudal) width of pronotum, 4.6; length of tegmen, 14; greatest width of dorsal field of tegmen, 3.8; length of caudal femur, 9.5; length of ovipositor, 7.2.

The type and allotype of this very distinct species are the only individuals seen by us.

**Podoscirtus amusus** Saussure

1878. *P[odoscirtus] amusus* Saussure, Mélang. Orthopt., ii, fasc. vi, pp. 776, 781. [Pernambuco, Brazil.]

Independencia, Parahyba. (Mann and Heath.) One female.

This specimen is slightly under the original measurements given by Saussure, and it differs in a few very minor features, such as the number of spinulations between the principal spines on the dorsal margins of the caudal tibiae, but in all characters of specific importance it is in full agreement with the description. Saussure says of *amusus*, "Abdomen noir, avec une bande latérale fauve," but it is well to emphasize that the black is only on the dorsal surface, as it is not indicated on the venter.

This is apparently the first record of the species since the original description.

**Aphonomorphus**[38] **cearensis** new species (Plate IV. figs. 38, 39, 40, 41 and 42.)

A very striking small species with a decided and distinctive color pattern, related to *A. griseus* Chopard, from Cayenne, and apparently to *A. hapitheformis* Bruner, from south-central Brazil and eastern Bolivia. From *griseus* it differs in the less decided

[38] We have now before us the unique female type of *Platydactylus fasciatus* Scudder (Proc. Bost. Soc. Nat. Hist., xii, p. 331, (1869) ), from the Napo or Marañon River. The original describer at a later date, in his revision of the exotic species described by him (Ibid., xxvii, p. 216, (1896) ), referred this species to the genus *Eneoptera*, to which, however, it is in no way closely related. The type is much battered, possesses only a few of the proximal joints

pubescence, in the more excavate fastigium, less conspicuous ocelli, in the strongly securiform distal palpal joint, in the shorter pronotum, which has the caudal margin less strongly bisinuate, in the slightly longer than deep lateral lobes of the pronotum, in the entire apex of the male subgenital plate, in the more elongate limbs, in the less numerous rami of the mediastine vein of the tegmina, in the less numerous spines on the dorso-internal margin of the caudal tibiae and in the coloration of the pronotum, dorsal field of the tegmina and of the limbs. From *hapitheformis* the new species differs in the shorter caudal femora, in the narrower tegmina, in the broad foraminal orifice on the cephalic face of the cephalic tibiae, in the dorso-external margin of the caudal metatarsi bearing three spines, and in the distinctive coloration of the dorsal field of the tegmina and of the limbs and palpi.

Type.—♂; Maranguape Mountains, State of Ceará, Brazil. (Stanford Brazilian Expedition; W. M. Mann.) [Acad. Nat. Sci. Phila., Type no. 5334.]

of each antenna, has lost both caudal limbs, a portion of one median one, all of one cephalic limb and all but the femur of the other, in addition to which the palpi are missing. It would seem from Scudder's failure to mention limb characters, that the present condition of the specimen obtained at the time of description. The species is an *Aphonomorphus*, quite close to, if not identical with, *A. telskii* Saussure, from Bolivia and Peru. Scudder's specimen differs, apparently, from Saussure's description in having the caudal margin of the pronotum distinctly obtuse-angulate mesad, instead of arcuate and strongly bisinuate as described for *telskii*. The relationship to *variegatus* Chopard, from Cayenne, is also close, and the same is true of *obliquus* Bruner, from Bolivia, but *fasciatus* is evidently more distinct from these than from *telskii*. We are unable to give certain desired comparisons on account of the lack of the important palpal and tibial features, as well as the lack of material of *telskii* for physical comparison.

The ocelli are distinct, in an arcuate line, the lateral ones slightly larger and more circular than the median one, which is distinctly elliptical. The principal measurements of the type of *fasciatus* are: length of body, 19.2 mm.; length of pronotum, 3.4; greatest (caudal) width of pronotal disk, 5.1; length including tegmen, 29.6; length including wing, 35; length of tegmen, 26.5; length of ovipositor, 17.

Size small (for the genus): form moderately elongate, subdepressed: surface finely adpressed pilose except the dorsum of the pronotum, the lateral lobes of the pronotum and the tibiae being quite thickly covered. Head moderately broad: occiput but moderately declivent cephalad, the fastigium and interocular region strongly and broadly excavate, the rostrum and antennal scrobes sharply cut off from the fastigium by a transverse shoulder, which forms, when seen from the dorsum, a very broad, U-shaped figure with diverging arms, on the cephalic face of this shoulder are situated the ocelli: median ocellus of medium size, ovate, the ventral portion fossetted, well separated from the lateral ocelli; lateral ocelli elongate elliptical, concave in form,[39] not touching the eyes, distinctly longer than the median one: rostrum very narrow, its least width, which is parallel to the axis of the antennal insertion, being not more than two-thirds the width of the proximal antennal joint, the lateral outline of the rostrum arcuate from the median ocellar fossette ventrad: palpi elongate; the third and fourth joints slender, simple, subequal in length; the fifth joint broadly securiform, the extensor margin concave, the flexor margin strongly convex, the distal margin truncate, the base very slender, the distal section appreciably expanded laterad: eyes slightly prominent, in basal outline short and broad miter-shaped, the greatest width contained about one and one-half times in the depth: antennae reaching at least as far as the tips of the closed wings, proximal joint broad, subdepressed. Pronotum transverse, the median length contained about one and one-half times in the greatest caudal width of the disk: cephalic margin of disk truncate; caudal margin quite strongly bisinuate, arcuate obtuse-angulate mesad; both margins cingulate, the caudal more widely so than the cephalic; lateral borders of the disk appreciably and regularly diverging caudad; paired lateral impressions of disk elliptical, a distinct and moderately decided impression in the middle of the disk: lateral lobes of the pronotum weakly longitudinal, the greatest depth contained one and one-third times in the length of the lobe; ventral margin distinctly and regularly arcuate, the ventro-cephalic angle broadly rounded, the caudal angle obtusely rounded, margins finely cingulate cephalad and ventrad, very broadly lamellato-cingulate ventro-caudad; surface of the lobes much impressed ventro-caudad. Tegmina elongate, relatively narrow, the tips very faintly surpassing the apices of the caudal femora and surpassing the apex of the abdomen by nearly the length of the head and pronotum combined, when seen from the dorsum the closed dorsal fields narrow regularly from the base: costal margin very faintly concave at its middle: lateral field subequal in width from the base to its middle, thence narrowing to its apex, which very shortly precedes that of entire tegmen: mediastine vein with five rami, the lateral field with four free veins; humeral and discoidal veins in the proximal half following the curve of the mediastine vein, thence the discoidal forms the internal border of the lateral field; the humeral vein distad follows the general course of the discoidal vein, somewhat irregular and sending off poorly

[39] These are similar to the shape of the antennal fossae immediately ventrad and are probably a development to permit of the antennae being directed caudad, the large proximal joint having little play, without some cutting away in this region.

defined rami toward the costal margin distad of the extremity of the mediastine vein: dorsal field areolate-reticulate with fair-sized interstices, oblique pseudosectors four in number, distad of which are two strongly longitudinal sectors, which are rami of the median vein, and proximad of which is a closely placed series of three straight, oblique, analo-axillary veins. Wings projecting distad of the closed tegmina a distance almost equal to that of the head and pronotum combined. Cerci short, not more than twice as long as the subgenital plate, robust and tapering in the distal half, the apex rather abruptly tapered; distal half decurved: subgenital plate deplanate ventrad, non-sulcate, the lateral margins narrowing distad; apex of the plate rather sharply truncate. Limbs slender; third joint of all tarsi very slender. Cephalic tibiae imperforate on caudal face, with an elongate ovoid foramen on the cephalic face. Caudal femora quite slender, the greatest depth contained four and one-half times in the length of the same: caudal tibiae with five major spines, which are quite slender, on each dorsal margin distad; intercalated spinulations reading distad-3, 3, 0, 0, on each margin; external distal spurs very small; internal spur group with the dorsal one large, the intermediate but little more than one-half as long as the dorsal and the ventral one one-third as long as the dorsal one: caudal metatarsi short, dorsad armed with two spinulations on the external margin and one on the internal one; internal metatarsal spur about as long as the metatarsus.

General coloration cinnamon-buff, brightening to light buff and pinkish buff as follows: narrow postocular line which is continued over the shoulder of the pronotum and proximal third of the humeral angle of the tegmina; four equally narrow, longitudinal, occipital lines on the head, the median pair connected cephalad; a pair of fine sigmoid lines obliquely crossing the eye and separated by a narrow fuscous division. Antennae with infrequent and rather weak annuli of fuscous, which are more numerous distad: ocelli pinkish buff; dorsal section of antennal scrobes and most of face blackish fuscous, except for a central trefoil figure on the face: genae washed with natal brown: palpi with the second, third and fourth segments lined on the external and internal faces with fuscous, distal joint with the same distad, a dorsal lining of buff on the third and fourth joints. Pronotum with dorsal surface, except lateral angles and paired impressed areas, washed with buckthorn brown, a medio-longitudinal line of blackish fuscous present; lateral lobes washed with natal brown, pubescence pale golden. Tegmina with the dorsal field having five distinct groups of blackish fuscous markings along the oblique "sectors," other scattered points of the same color indicated, particularly distad, a distinct, well-spaced beading of fuscous black along the median vein; vicinity of the proximal two-fifths of the humeral vein continuously marked with fuscous black, costal margin with a faint ticking of fuscous distad. Abdomen with dorsum fuscous and a relatively broad medio-longitudinal bar on the center of the same color, this as wide distad as the truncate extremity of the subgenital plate: cerci pale ochraceous buff with the distal extremity sharply fuscous. Cephalic femora, the greater portion of the cephalic tibiae and tarsi, the disto-ventral section of the median femora, much of the median tibiae and

tarsi, the ventral half of the caudal femora and the lateral and ventral faces of the caudal tibiae and tarsi, blackish fuscous; ocelliform spots of the general color are placed in the fuscous areas on the cephalic and median femora and tibiae, and a sparse beading of the same color is present on the ventro-external margin of the caudal femora; dorsal surface of the cephalic tibiae weakly hay's russet, a faint indication of the same on the median tibiae; caudal tibiae with the dorsal surface clear buff-yellow.

Length of body, 12.1 mm.; length of pronotum, 2.1; greatest (caudal) width of pronotum, 3.3; length of tegmen, 13.3; greatest width of dorsal field of tegmen, 3; length of caudal femur, 9.6.

The type of this striking and interesting species in unique.

**Aphonomorphus novus** new species (Plate IV, figs. 43, 44, 45, 46 and 47.)

A very distinct species, showing so many characteristic features that it is inadvisable to give a comparative diagnosis. Its main features are: its small size, slender form (in both sexes), its greatly expanded distal palpal joint, its distinctly longitudinal and relatively complete tegminal venation, which is also in high relief, its pauciramose tegminal mediastine vein, its narrow, yet elliptical, foramen on the cephalic face of the cephalic tibiae, its caudal tibiae with five spines on each dorsal margin and its caudal metatarsi with two teeth on each lateral margin. The structure of the subgenital plate of the male much suggests that of *hapitheformis* Bruner and *cearensis*, described above, but no really close relationship to these species exists.

Type.—♂; Independencia, State of Parahyba, Brazil. (Stanford Brazilian Expedition; Mann and Heath.) [Acad. Nat. Sci. Phila., Type no. 5335.]

Size small: form slender, elongate, in general section subquadrate: surface of body adpressed pubescent, of tegmina very delicately pubescent, this microscopic. Head with its width no greater than the cephalic width of the pronotum, the eyes not projecting laterad of the general outline of the head: occiput, fastigium and dorsal section of the rostrum to the angle, which is interantennal, regularly and strongly declivent; rostrum nearly rectangulate in lateral outline, its least width less than one-half that of the proximal antennal joint, fossulate dorsad: ocelli large, placed in a strongly arcuate line; median one quite large, nearly circular, placed in the fossulation at the base of the rostrum; lateral ones slightly smaller than the median one, elliptical, moderately separated from the median ocellus and well removed from the eye. the surface of the lateral ocelli concave: palpi of medium length; third and fourth joints simple, the fourth slightly shorter than the third; fifth joint securiform, the dorsal outline of the joint straight, the distal margin truncate, the ventral

margin strongly arcuate: eyes weakly projecting cephalad, appreciably compressed laterad, in basal outline subreniform, broader dorsad than ventrad: antennae at least twice as long as the body, relatively heavy, moniliform, the joints longest mesad; proximal joint depressed, its dorsal surface impressed. Pronotum moderately transverse, its median length contained about one and one-half times in the greatest caudal width of the same, dorsal surface strongly arcuate in transverse section, broadly rounding into the lateral lobes: cephalic margin of disk concavo-truncate, caudal margin bisinuate laterad, very broadly obtuse-angulate mesad; lateral borders of disk regularly, though not strongly, diverging caudad; paired impressions of the disk ovoid in shape: lateral lobes decidedly longitudinal, slightly deeper caudad than cephalad, the caudal depth contained about one and two-thirds times in the greatest length of the lobes; ventral margin of the lobes arcuate, the ventro-cephalic and caudal angles broadly rounded. Tegmina reaching to the apices of the caudal femora and surpassing the apex of the abdomen by the length of the head and pronotum combined, very elongate, the greatest width of the dorsal field contained nearly five and one-half times in the length of the same: lateral field subequal in depth in proximal third, regularly narrowing thence; mediastine vein triramose; lateral field with three free veins proximad; humeral and discoidal veins simple: dorsal field with sharply defined, elevated and regularly spaced, relatively simple, longitudinal venation, the cross-veins weak, rather irregular and often sigmoid: median vein straight, with three rami, which are as longitudinal as the median vein itself, the distal more distinct in its origin than the median and proximal ones; anal and three axillary veins distinct and regular. Exposed portion of the closed wings slightly longer than the length of the head and pronotum combined. Cerci short, not surpassing the apices of the tegmina when extended, sharply tapering proximad, very gradually so and very slender distad, falcate, strongly decurved: subgenital plate as in *cearensis* but the distal margin weakly arcuate. Limbs slender, the cephalic and median femora deeper than usual in limbs in general so slim: third tarsal joint slender in all tarsi. Cephalic tibiae with cephalic face having an elongate elliptical foramen, imperforate on caudal face. Caudal femora with the greatest depth contained about four and one-half times in the greatest length: caudal tibiae very slender; dorsal margins armed distad with five major spines, which are very slender, the intercalated spinulations on the external margin numbering (reading distad) 6, 5, 2, 2 or 4, 4, 3, 2—on the internal margin, 3, 3, 2, 1 or 3, 3, 3, 1; distal external spurs small, the dorsal little more than half as long as the median, and the ventral but little smaller than the median; distal internal spurs elongate, the ventral about two-fifths as long as the dorsal, which latter is but little shorter than the metatarsus: caudal metatarsi with dorso-external margin with two spinulations, dorso-internal margin with a single (distal) spinulation; internal metatarsal spur about as long as the metatarsus, external one somewhat shorter.

Allotype.— ♀ ; Same data as type. [Acad. Nat. Sci. Phila.]

Differing from the description of the male (type) in the following features. Size larger. Head slightly shorter and broader: eyes less projecting cephalad:

genae more inflated than in the male. Tegmina with dorsal field having eight almost longitudinal sectors, the four distal being rami of the median vein, the next is the ulnar vein, the anal following and finally two axillary veins: the sectors derived from the median vein are connected by infrequent cross-veins, which are placed at right angles to the rami themselves, between the other sectors the cross-veins are nearly longitudinal, somewhat irregular in position and distinctly sigmoid in shape, excepting distad, where the cross-veins take the position and disposition they assume between the sectors derived from the median vein, a tendency toward false intercalated longitudinal nervures is seen proximad. Cerci slightly surpassing the tips of the tegmina. Ovipositor but slightly shorter than the caudal femora, compressed; apex acuminate, the extreme tip very acute, ventro-laterad armed with strong, rather irregular, recurved teeth, the dorsal surface of the apex slightly flattened, the external surfaces moderately rounded and strongly shagreened. Caudal tibiae with intercalated spinulation formula on the external margin, 7, 6, 3.2—on the internal margin, 4, 4, 3, 0.

Coloration tones completely destroyed by immersion in a liquid preservative. The only evident features are: a regularly placed pattern of very small fuscous punctulations on the pronotum, cephalic and median limbs, distal extremity of the caudal femora and (sparsely) greater portion of the caudal tibiae; a relatively narrow fuscous postocular bar on the head and pronotum, which is narrow and not sharply defined; a medio-longitudinal bar of fuscous on the head and pronotum, this being divided by a thread of the general color; lining with fuscous of the proximal third of the humeral vein of the tegmina; median vein of the wing sparsely and strongly, and the longitudinal veins of the exposed portion of the folded wings, more closely and less distinctly, ticked with fuscous; eyes obliquely trilineate with fuscous, the lines somewhat sigmoid; antennae very sparsely annulate with fuscous; ventral surface of the caudal tibiae washed with weak fuscous; ovipositor narrowly lined with fuscous laterad, the apex ventrad washed with the same.

♂ (*type*). Length of body, 10.6 m.; length of pronotum, 1.9; greatest (caudal) width of pronotum, 2.8; length of tegmen, 11.8; greatest width of dorsal field of tegmen, 2.2; length of caudal femur, 9.2.

♀ (*allotype*). Length of body, 12.2 mm.; length of pronotum, 2.2; greatest (caudal) width of pronotum, 3.3; length of tegmen, 13.3; greatest width of dorsal field of tegmen, 2.5; length of caudal femur, 11.1; length of ovipositor, 8.8.

The type and allotype are the only specimens of this easily recognized species seen by us. The variation in the formulas of the intercalated spinulations of the dorsal margins of the caudal tibiae show how unimportant these features are, and how little dependence can be placed upon them as diagnostic characters.

**Aphonomorphus peruvianus** (Saussure)

1874. *Aphonus peruvianus* Saussure, Miss. Scient. Mexiq., Rech. Zool., vi, pp. 510, 511. [Tarma, Peru.]

Madeira-Mamoré Railroad Company Camp 41, Rio Madeira. (Mann and Baker.) One male.

The present specimen agrees quite well with the original description, except that the median ocellus is ovate instead of round, more ovate than the lateral ones, and for the presence of a very weak, medio-longitudinal impression distad on the subgenital plate of the male, which plate is described as "non cannelée." Until we are able to compare the Rio Madeira specimen with material more fully typical of *peruvianus*, we prefer to use that name, tentatively, for the present individual.

**Tafalisca bahiensis** (Saussure)

1878. *M[etrypus] bahiensis* Saussure, Mélang. Orthopt., ii, fasc. vi, pp. 812, 816. [Bahia, Brazil.]

Independencia, Parahyba. (Mann and Heath.) One female.
Pará, Pará. (C. F. Baker.) One female.

These specimens are referred to *bahiensis* with some uncertainty, as they show certain differences from the original description which may be of specific worth, or may, as seems to us more probable, be features of individual variation. The latter opinion is strengthened by the differences between the two specimens in hand, which, while certainly representing the same species, vary in size, intensity and continuity of the dark head marking and spination of the dorsal surface of the caudal metatarsi. From Saussure's description of *bahiensis* the present material differs in the slightly smaller pronotum, in the caudal margin of the disk of the same being but moderately arcuate instead of angularly rounded, and in the caudal metatarsi having the dorsal surface armed with 2:3 or 3:3, instead of 2:4, spiniform denticulations. Each of the present specimens possesses but a single caudal limb, and the Pará specimen has the 3.3 formula on the single metatarsus, the Independencia individual the 2:3 arrangement. The present specimens have the darker pattern of the head strongly infuscate, while the angle of the tegmina has the trunk with a greater (Pará) or less (Independencia) amount of infuscation, as is true of the apex of the caudal femora. It seems that, aside from the pronotum, the described reddish

areas are darkened in the present representatives. In the Independencia female the pronotum bears a distinct, fuscous, postocular bar, while both specimens have paired short, infuscate, infraocular bars on the head. The dorsal ovipositor valves are little expanded, the margins moderately arcuate acuminate; the ventral valves are less acuminate, with the margins of these coarsely, but not deeply, crenulato-dentate, of the dorsal valves finely multicarinulate distad on the dorsal surface. The measurements (in millimeters) of the specimens are as follows:

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Length of caudal femur | Length of caudal tibia | Length of ovipositor |
|---|---|---|---|---|---|---|---|
| Pará | 20.5 | 4.7 | 4.7 | 14.4 | 13 | 9 | 10.8 |
| Independencia | 18.3 | 4.2 | 4.3 | 13.6 | 10.8 | 8.4 | 9.6 |

## EXPLANATION OF PLATES

### Plate III

Fig. 1.—*Hyperophora branneri* new species. Dorsal view of apex of abdomen of male (*type*). ( × 3)

Fig. 2.—*Hyperophora branneri* new species. Stridulating field of tegmen of male (*type*). ( × 3)

Fig. 3.—*Hyperophora abrupta* new species. Dorsal view of apex of abdomen of male (*type*). ( × 3)

Fig. 3 A.—*Hyperophora abrupta* new species. Stridulating field of tegmen of male (*type*). ( × 3 )

Fig. 4.—*Ceraia grandis* new species. Dorsal view of apex of abdomen of male (*type*). ( × 3)

Fig. 5.—*Ceraia grandis* new species. Lateral outline of ovipositor and subgenital plate. *Allotype*. ( × 2)

Fig. 6.—*Ceraia madeirensis* new species. Outline of sternal lobes. *Type*. ( × 4)

Fig. 7.—*Ceraia madeirensis* new species. Lateral outline of ovipositor and subgenital plate. *Allotype*. ( × 3)

Fig. 8.—*Anaulacomera rusa* new species. Lateral outline of apex of abdomen of male (*type*). ( × 4)

Fig. 9.—*Anaulacomera rusa* new species. Ventral view of apex of abdomen of male (*type*). ( × 4)

Fig. 10.—*Anaulacomera ovibos* new species. Ventral outline of subgenital plate of male (*type*). ( × 5)

Fig. 11.—*Anaulacomera ovibos* new species. Caudal aspect of apex of abdomen of male (*type*). ( × 3)

Fig. 12.—*Anaulacomera ovibos* new species. Lateral view of apex of abdomen of male (*type*). ( × 3)

Fig. 13.—*Anaulacomera bovicula* new species. Caudal aspect of apex of abdomen of male (*type*). ( × 3)

Fig. 14.—*Anaulacomera bovicula* new species. Lateral view of apex of abdomen of male (*type*). ( × 3)

Fig. 15.—*Coelophyllum crassum* new species. Dorsal aspect of head, pronotum and stridulating field of tegmen of male (*type*). ( × 2)

Fig. 16.—*Coelophyllum crassum* new species. Lateral outline of tegmen of male (*type*). ( × 2)

Fig. 17.—*Teleutias tortus* new species. Dorsal aspect of pronotum of male (*type*). ( × 3)

Fig. 18.—*Teleutias tortus* new species. Apex of abdomen of male (*type*) from dorsum. ( × 3)

Fig. 19.—*Oecanthus pictipes* new species. Outline of dorsum of pronotum of male (*type*). ( × 5)

Fig. 20.—*Oecanthus pictipes* new species. Dorsal field of male tegmen (*type*). ( × 3)

Fig. 21.—*Occanthus pictipes* new species. Lateral field of male tegmen (*type*). ( × 3)

Fig. 22.—*Paroecanthus roosevelti* new species. Cephalic face of cephalic tibia of *type*. (Greatly enlarged.)

Fig. 23.—*Paroecanthus roosevelti* new species. Foramen on caudal face of cephalic tibia of *type*. (Greatly enlarged.)

Fig. 24.—*Paroecanthus roosevelti* new species. Palpus of *type*. (Greatly enlarged.)

Fig. 25.—*Paroecanthus roosevelti* new species. Outline of dorsal field of tegmen of male (*type*). ( × 2)

Fig. 26.—*Paroecanthus roosevelti* new species. Apex of dorsal valves of ovipositor of *allotype*. (Greatly enlarged.)

## Plate IV

Fig. 27.—*Amblyrhethus manni* new species. Outline of dorsal field of tegmen of male (*type*). ( × 2)

Fig. 28.—*Amblyrhethus manni* new species. Outline of lateral lobe of pronotum of *type*. ( × 3)

Fig. 29.—*Amblyrhethus manni* new species. Cephalic aspect of head of type. ( × 4)

Fig. 30.—*Amblyrhethus manni* new species. Dorsal outline of apex of single dorsal valve of ovipositor of *allotype*. (Greatly enlarged.)

Fig. 31.—*Amblyrhethus manni* new species. Ventral outline of apex of single ventral valve of ovipositor of *allotype*. (Greatly enlarged.)

Fig. 32.—*Amblyrhethus manni* new species. Cephalic face of cephalic tibia of type. (Greatly enlarged.)

Fig. 33.—*Amblyrhethus natalensis* new species. Outline of dorsal field of tegmen of male (*type*). ( × 2)

Fig. 34.—*Amblyrhethus natalensis* new species. Cephalic aspect of head of type. ( × 4)

Fig. 35.—*Amblyrhethus natalensis* new species. Dorsal outline of apex of single dorsal valve of ovipositor of *allotype*. (Greatly enlarged.)

Fig. 36.—*Amblyrhethus natalensis* new species. Ventral outline of apex of single ventral valve of ovipositor of *allotype*. (Greatly enlarged.)

Fig. 37.—*Amblyrhethus natalensis* new species. Cephalic face of cephalic tibia of *type*. (Greatly enlarged.)

Fig. 38.—*Aphonomorphus cearensis* new species. Dorsal outline of pronotum, tegmina and closed wings of male (*type*). ( × $2\frac{1}{2}$)

Fig. 39.—*Aphonomorphus cearensis* new species. Cephalic aspect of head of type. ( × 6)

Fig. 40.—*Aphonomorphus cearensis* new species. Outline of subgenital plate of male (*type*). (Greatly enlarged.)

Fig. 41.—*Aphonomorphus cearensis* new species. Palpus of type. (Greatly enlarged.)

Fig. 42.—*Aphonomorphus cearensis* new species. Cephalic face of cephalic tibia of type. (Greatly enlarged.)

Fig. 43.—*Aphonomorphus novus* new species. Lateral outline of pronotum of type. ( × 5)

Fig. 44.—*Aphonomorphus novus* new species. Dorsal outline of head, promotum, tegmina and closed wings. ( × $3\frac{1}{4}$)

Fig. 45.—*Aphonomorphus novus* new species. Outline of subgenital plate of male (*type*). (Greatly enlarged.)

Fig. 46.—*Aphonomorphus novus* new species. Palpus of type. (Greatly enlarged.)

Fig. 47.—*Aphonomorphus novus* new species. Cephalic face of cephalic tibia of type. (Greatly enlarged.)

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National

# NEPTICULIDAE OF NORTH AMERICA

BY ANNETTE F. BRAUN

## *Description of the Family*

The genera composing the family Nepticulidae form a well-defined and easily recognized group which possesses structural characters sharply distinguishing it from all other Lepidoptera. *Scoliaula* and *Trifurcula* of the European fauna, *Obrussa, Glaucolepis* and *Ectoedemia* of the North American fauna, are monobasic or at most represented by but a few species each; *Nepticula*, which is almost cosmopolitan in its range, appears to be unlimited in number of species. The family includes the smallest of the Lepidoptera; some species of *Nepticula* expand scarcely three millimeters.

The moths, because of their minute size and retired habits, and very rapid and irregular flight, are not frequently met. Early in the spring, some species may be collected resting in the crevices of bark. Later, moths may sometimes be found on leaves, usually those of their food plants. Occasionally because of the peculiarity of all the individuals of a single generation maturing and emerging at the same time, great numbers of moths may be seen on leaves of the food plant and neighboring plants. To secure an adequate representation of the group, however, rearing of the moths from larvae is necessary.

The family characteristics of the Nepticulidae may be given as follows:

Head and face tufted. Antennae not exceeding three-fourths of wing length, rather thick, with basal segment enlarged and concave beneath to form an eye-cap. Labial palpi short, porrected or drooping. Maxillary palpi long, filiform, folded. Tongue rudimentary. Posterior tibiae with bristles above.

*Fore wings* (Figs. 1 to 6).—Media coalescing with radius from base to beyond middle of wing, so that all the branches of radius and media appear to arise from one stem; or coalescing with cubitus for a short distance from base, then, either passing obliquely

outward to radius just beyond $R_{2+3}$, and anastomosing with radius to beyond middle of wing, as before, or remaining separate from radius, in which case (*Trifurcula*) $R_{4+5}$ is absent. $R_{2+3}$ coincident. $R_{4+5}$ separating beyond M, or coalescing to apex. Cubitus unbranched, sometimes coincident with M or becoming obsolete beyond its point of separation from M. Second anal vein very prominent. Cross veins absent. A jugum is present in females of the more primitive genera.

*Hind wings* (Figs. 1 to 6).—Subcosta and $R_1$ coincident; $R_s$ and M coalescing to about the middle of the wing. Media one or two branched. Cubitus unbranched. No cross veins. Frenulum of male consisting of a single strong spine; of female rudimentary, of several minute spines. The function of the frenulum is performed in the female by a series of curved spines along base of costa. One-half to almost as broad as the fore wings.[1]

*Fore wings.*—1b very prominent, simple at base; 2 often becoming obsolete; 3 absent, veins present between 4 and 8 seeming to arise from one stalk; stalk apparently arising from lower median or from upper median beyond 10, sometimes connected with lower median just beyond 10. 9 absent.

*Hind wings.*—3 and 4 absent; cell open between 2 and 5+6.

A striking and unique characteristic of the family is the entire absence of true cross veins. That the apparent cross vein present in some genera, passing obliquely from cubitus to radius just beyond $R_{2+3}$ is in fact a portion of media, is shown by studies on the tracheae of pupal wings published elsewhere, and by the occasional persistence in the imago of the tracheae which precede the wing veins.

Discussion of the origin and phylogenetic relationships of the family is reserved until a more complete account of the structure of the various parts is given.

The *head* is rough tufted, both on the face and crown. This tuft is composed of irregular hair-like scales, usually of a color contrasting with the eye-caps and with the rest of the body. Behind the tuft and eyes, the scales form a pair of flap-like structures, usually lying flat, but sometimes erected in dead

[1]Owing to the fact that in the greater part of the published work on Microlepidoptera the Comstock-Needham system of vein nomenclature has not been used, the following characterization of the venation is given for purposes of convenience.

specimens, the so-called "collar." This collar may be concolorous with the eye-caps, thus contrasting with the thorax, or it may be concolorous with the thorax or tuft, in which case it is inconspicuous. The antennae are comparatively short, usually not exceeding two-thirds of the wing length, rather thick with the basal segment dilated and concave beneath to form an eye-cap, which is usually clothed with white or whitish scales. The tongue is very short, curled, the two halves rather easily separated, and less than half the length of the six-jointed and folded maxillary palpus. The labial palpi are well-developed, porrected in life, usually drooping in the dead insect.

The two pair of *wings* are in general similar in shape, elongate ovate, pointed. In the male the humeral area of the hind wing is usually considerably expanded (Fig. 2), resulting in a broadening of the basal half of the wing; often the costa is excised beyond the middle.

The most striking peculiarity of the venation of the fore wings is the tendency for the base of media to coalesce with radius or with the base of cubitus, in contrast to the course taken in the majority of the Lepidoptera, where its disappearance takes place through atrophy. The supposed "cross vein" which, when present, closes cell R, is a portion of media, and its presence indicates the coalescence of the basal part of media with cubitus. This difference in the course taken by the medial trachea is not of taxonomic significance, since in *Nepticula* we find the respective conditions present in two otherwise closely related species, and sometimes in individuals of the same species, *e.g.* in *N. nyssaefoliella* (Figs. 1 and 2). As an extreme case of coalescence, exhibited in *Scoliaula*, we find but a single main vein traversing the middle of the wing, from which all veins, except the anal veins, seem to arise. The extraordinary development of the second anal vein, which forms a projecting ridge on the underside of the fore wing, more striking in the female, is apparently correlated with its function of serving as a fastening for the row of spines along the costal margin on the upper side of the hind wing of the female, which here preserve their primitive function of locking the two wings together (Figs. 1, 3 and 5). The true frenulum in the female consists merely of a group of minute func-

tionless spines. In the male, however, the frenulum is represented by a single strong spine (Figs, 2, 4 and 6) which hooks into a well-developed frenulum-hook. Near the base of the dorsal margin, best observed in the female of species of *Ectoedemia* (Fig. 3), is a structure which may be interpreted as a jugum, vestigial in the males even of the more primitive genera, probably functional in females of *Ectoedemia*.

Projecting from the wing membrane are numerous minute curved pointed hairs, the "fixed hairs" or aculeae. These are most numerous on the underside of the fore wing, near the dorsum.

The scale-covering of the wings consists in general of the usual flat, striated, toothed scales, amongst which are scattered hair scales. In the more primitive species the scales are uniform in structure over the wing membrane, and are almost or quite lusterless. The tendency in such species is toward a general dull ocherous or drab color, without definitely defined markings. Later we find the fore wings with definite markings in the shape of fasciae and spots, which, in more specialized species, become sharply defined through the structural differentiation of the scales forming them, so that the wings are ornamented with metallic silvery, golden or bluish spots and fasciae; finally, the entire fore wing is clothed with these metallic scales. The cilia are composed of hair-like scales or of very attenuated scales of the striate toothed type—the latter occur most commonly in the costal and apical areas.

In the males of some species, androconia are present, forming an oval opaque area on the upper side of the hind wing from the base to near the middle of the wing (shown in dotted outline on Figs. 2 and 6). Various other secondary sexual characters, in the nature of tufts of scales and hairs are present. The series of spines along the costal margin of the hind wing, which serve in the female to hold the two wings together, have in the male, with few exceptions, entirely lost their original function. In rare instances (*e.g. N. rhamnicola*) these spines have preserved in the male a structure and function identical with those in the female. In the earlier genera, and in the more primitive species of later

genera, these structures though modified have not entirely lost their spine-like character (Fig. 4). Even where modified, they may be distinguished from the rest of the scale covering of the hind wing by the fact that they are thicker, yellowish, more heavily chitinized structures. Instead of projecting forward, they extend obliquely backward, lying flat on the surface of the wing. In some species of *Nepticula*, these spines become greatly elongated, forming a flattened bunch of hairs lying on the wing within the costa (Fig. 2).

A feature common to all the genera is the presence of bristles on the upper side of the posterior tibiae. The position of the middle spurs of the posterior tibiae—whether situated in the middle, or above or below the middle—is a generic character.

With the exception of several gall-making species of *Ectoedemia*, the larvae of all species of which the life history is known, are miners within the tissues of leaves (rarely in fruits) or in bark. They show a preference for trees and shrubs, but not a few mine leaves of herbaceous plants. When full grown, the larva, with few exceptions, leaves the mine and dropping to the ground, spins a dense flattened cocoon amongst the rubbish or in the loose surface soil.

The *egg* is a minute oval body attached to the surface of the leaf or bark by a minute glistening speck of cement, which renders its location visible even to the naked eye.

The *larva* of *Nepticula* upon hatching eats directly into the leaf, and makes a very narrow linear mine, which is at first often difficult to discern, since in its early stages, the larva consumes but a small part of the leaf tissue. This mine may continue as a linear mine, gradually broadening throughout its course, or it may at some period abruptly enlarge into a blotch. In the latter portions the mine is semitransparent and easily visible. The mine of any one species is very constant and characteristic in appearance, and in most instances serves for immediate identification of the species. The species of *Ectoedemia* are gall-producers or bark-miners in forest trees.

The *larva* is slightly flattened, with head deeply retracted into the prothorax, due to the lengthening of the dorsal side of the head. For the details of head structure, the reader is referred to

the work of other writers, particularly Traegaardh[2]. Locomotor organs are represented by mere roughened protuberances; such rudimentary feet are present on segments three and four, on segments six to eleven and sometimes on the last segment in *Nepticula*; in *Ectoedemia* there are sometimes one or two additional pairs of rudimentary processes.

The *cocoon* is spun of dense brown or yellowish silk, flattened oval in general outline, but usually broader at its anterior end, around which a fissure extends, guarded by the smooth projecting edges of the two halves of the cocoon. Through this fissure the pupa is thrust at emergence. In some species, the flat projecting edges form a rim extending entirely around the cocoon.

The *pupa* is flattened ovate; all the appendages are free and segmented; segments one to seven of the abdomen are free. The resemblance to the pupa of the primitive Eriocranianae has been pointed out by Miss Mosher in her paper on "A Classification of the Lepidoptera based on Characters of the Pupa."[3]

The *moth* is active almost immediately after emergence, running rapidly up and down the sides of the breeding jar, and in an incredibly short time has the full use of its wings. When at rest the wings lie almost horizontal, meeting in a line down the middle of the back.

From the phylogenetic point of view, the Nepticulidae is probably one of the most interesting and instructive groups of Microlepidoptera, combining as it does, characters of acknowledged specialization with primitive, almost Trichopteran characters.

A number of characters obviously ally this family to the Eriocranid group of the Micropterygidae. Such characters are the primitive structure of the pupa in comparison to that of other Lepidoptera, and its many points of resemblance to the Eriocranid pupa, and the presence of the vestigial jugum, which can be discerned readily in females of *Ectoedemia* and *Obrussa*.

The row of slightly curved spines near the costal margin of the hind wing of the female, which presses against or hooks onto a

[2] "Contributions toward the Comparative Morphology of the Trophi of the Lepidopterous Leaf-Miners" by Ivar Traegaardh; Arkiv for Zoologi, viii, no. 9, (1913), Stockholm.

[3] Bull. Ill. State Lab. Nat. Hist., xii, art. 2, (1916).

chitinized ridge extending along the underside of the second anal vein of the fore wing (or rarely along the base of the anal furrow), or catches into a series of similiar spines on the underside of the fore wing and functions to hold the wings together in flight, in place of either frenulum or functional jugum, is preserved in better condition than elsewhere in the Lepidoptera. Its homology with similar functional structures in Trichoptera can scarcely be questioned. That the presence in males of a single-spined frenulum is not inconsistent with otherwise primitive structure is shown by the fact that in some Trichoptera, both true frenulum spines and the series of hooked spines are present.[4]

As noted before, a similar condition is occasionally found in *Nepticula*, where both functional curved spines and single-spined frenulum occur together.

Such considerations suggest the possibility that the Nepticulidae may have been derived from ancestry of coördinate rank with the Micropterygidae, rather than that they are descended from that group itself.

The venation affords but little clue to the origin of the group. The tendency toward crowding together and anastomosis of the main tracheal branches is unique in the Lepidoptera, but it is perhaps significant that a similar tendency is seen in some of the small Trichoptera. The absence of true cross veins (the humeral cross vein alone is occasionally present) might be regarded as a primitive character; on the other hand it may be directly due to the anastomosis of the main veins.

### *Key to the Genera*

(European genera are included in brackets for convenience)

A. $R_5$ (vein seven) of fore wing present.

B. Media of fore wing with three branches (veins four, five and six present). **[Scoliaula]**

BB. Media of fore wing with one or two branches.

C. Media of fore wing with two branches (vein four absent).

D. Media of hind wing two-branched (veins five and six present). **4. Glaucolepis**

DD. Media of hind wing single-branched..... **3. Obrussa**

[4]Cf. Kellogg, V. L., "The Affinities of the Lepidopterous Wing;" Amer. Nat., xxix, pp. 709 to 719, (1895).

CC. Media of fore wing single-branched (veins four and five absent).
D. Middle spurs of posterior tibiae in or above the middle. 1. **Nepticula**
DD. Middle spurs of posterior tibiae below the middle.
2. **Ectoedemia**
AA. $R_5$ (vein seven) of fore wing absent. . . . . **[Trifurcula]**

1. **NEPTICULA** von Heyden[5]

*Nepticula* von Heyden, Berich. Vers. Naturf. Mainz, 201, (1842); Zeller, Linn. Ent., iii, 249, 301 to 303 (1848). Type: *Tinea aurella* F.

*Generic characters.*—Basal segment of antennae dilated and concave beneath to form a large eye-cap. Middle spurs of posterior tibiae in or above the middle. Fore wings elongate ovate, pointed; hind wings $\frac{1}{2}$ to $\frac{2}{3}$.

*Venation.* (Figs. 1, 2 and 5). Fore wings; media coalescing with radius from base to beyond middle of wing, or coalescing with cubitus at base and passing obliquely to radius beyond $R_{2+3}$, and anastomosing with radius to beyond middle of wing as before. $R_4$ sometimes coincident with $R_5$. Media single-branched. Cubitus usually reaching nearly to margin. Hind wings; media single-branched.

As far as known the larvae of all of the North American species are miners within the tissues of leaves. The egg is placed on either the upper or under surface of the leaf, often along the side of a vein, and the larva passes directly into the interior of the leaf. The larva usually mines just beneath the upper epidermis, consuming the palisade layer of cells, and in later stages, some of the spongy parenchyma cells (Fig. 7). In thin leaves the mine seems more transparent, because of the originally smaller number of these cells and the looseness of their arrangement. Where the upper or lower surface is mined indiscriminately, as is the case with leaves of poplar by *N. populetorum*, the cross-section of the leaf shows palisade cells on either side. Some species mine different sides of the leaf at different periods of larval life. The mine may be a linear tract, gradually increasing in breadth to its end, or it may at some point suddenly enlarge into a blotch. A change in the character of the mine usually indicates the beginning of a new instar. There are four larval instars. The mine formed during the first instar is very short, rarely exceeding a few millimeters in length. The large conspicious portion is made during the last larval instar in the few days preceding the escape

of the larva from the mine. The larva leaves the mine by a semicircular slit in the upper or the lower epidermis and spins the characteristic cocoon, usually brownish, but occasionally yellowish or whitish, in the surface soil or amongst rubbish, often near the base of the tree; occasionally it spins on the twigs or branches. Pupation does not take place immediately; in the summer generations it occurs a few days before emergence, in the overwintering generation it may be delayed until spring.

A few species have but one generation a year; most species (in the latitude of Cincinnati) have two or three; a few of the oak-feeding species may have as many as four generations. The length of the life cycle is approximately six weeks, except in the case of the single-generation species, where several months may elapse between oviposition and the attainment of full growth by the larva. The moths from the over-wintering generation of larvae emerge in May and June, a few species in April.

A comparison of blotch-making species with linear-mine species would seem to indicate that in some respects the former are more primitive, since these species are practically identical with the earlier *Ectoedemia* in wing structure. This is not universally true, however, and the fact that some of the smaller linear mine-making species (in which veins $R_4$ and $R_5$ are coincident and M coalescent with R) are very closely related in general habitus to these blotch-makers, may indicate that the differences in venation are directly due to size and breadth of wing.

Where species described in the genus *Nepticula* have not been available to the author for examination, they have been tentatively retained in this genus. Localities cited under geographical distribution without authority stated are from the author's personal observations.

Only the references to original descriptions and notes published subsequent to Dyar's List (1902) are cited under each species; for other references the reader is referred to Dyar's List. The scientific names of plants of the eastern United States are those used in Gray's New Manual of Botany (Seventh Edition).

[5]The name *Stigmella* Schranck (Fauna Boica, ii, (2), p. 169, (1802) is a *nomen nudum*, no species having been mentioned.

The few listed species named from larvae and not yet reared, are grouped at the end of the known species, with such additional information as has been secured about them.

*Key to the Species of Nepticula*

a. Fore wings with pale spots or fasciae.
b. A silvery or pale golden metallic spot at or very near the base of the wing.
c. A median fascia.
d. A costal and a dorsal spot at three-fourths....3. **pteliaeella**
dd. No such spots at three-fourths.
e. Thorax and extreme base of wing purple..1. **argentifasciella**
ee. Thorax and extreme base of wing golden.....2. **scintillans**
cc. No. median fascia ..... 4. **quadrinotata**
bb. Without such a spot.
c. Basal third of wing buff.....11. **cerea**
cc. Basal third of wing not buff.
d. A pale costal spot at one-third.....5. **trinotata**
dd. Without a pale costal spot at one-third.
e. Two pale fasciae.
f. Thorax creamy buff.....10. **rhamnicola**
ff. Thorax dark.
g. Head black..... .8. **intermedia**
gg. Head ochraceous.
h. First fascia dull yellow.....9. **diffasciae**
hh. First fascia shining.
i. Thorax and base of fore wing bronzy; expanse 5.5 mm. 6. **ceanothi**
ii. Thorax and base of fore wing purple; expanse 4 to 4.5 mm. 7. **bifasciella**
ee. One pale fascia.
f. Fascia more or less interrupted.
g. Male with a chitinous plate from base to near middle of costa of hind wing.
h. Fascia silvery ..... 38. **platanella**
hh. Fascia not silvery; male with long hair-pencil from base of costa of hind wing.....40. **similella**
gg. No such chitinous plate in male.....39. **clemensella**
ff. Fascia complete.
g. Fascia before the middle; wing lusterless.
h. Whitish costal and dorsal spots at three-fourths. 41. **thoracealbella**
hh. No such spots at three-fourths.....49. **latifasciella**
gg. Fascia in or beyond middle of wing.
h. Apex white .....28. **apicialbella**
hh. Apex not white (sometimes with white apical cilia).
i. Fore wing almost lusterless; fascia not more shining than remainder of wing.

j. Fascia at two-thirds ..37. **variella**
jj. Fascia at or near middle of wing.
k. Head, except eye-caps, black .35. **canadensis**
kk. Head not black.
l. Cilia, creamy white ..36. **ulmella**
ll. Cilia gray ..34. **fuscotibiella**
ii. Fore wing almost lusterless; fascia shining white, silvery or golden.
j. Collar white ..29. **tiliella**
jj. Collar not conspicuously paler than the head.
k. Apical cilia white; marginal line defined.
l. Expanse 4 mm ..30. **rubifoliella**
ll. Expanse 5 to 6 mm ..31. **nyssaefoliella**
kk. Apical cilia not white; marginal line not defined.
l. Head paler behind ..32. **slingerlandella**
ll. Head not paler behind ..33. **rosaefoliella**
iii. Fore wing with a metallic luster; fascia silvery or golden.
j. Fascia preceded by a purple or deep golden brown band. 17. **purpuratella**
jj. No such band.
k. Fascia the only pale marking.
l. Basal half of wing metallic golden or bronzy; fascia ill-defined internally.
m. Entire apical area deep purple. 16. **unifasciella**
mm. Costal half of apical area purple. 15. **resplendensella**
ll. Fascia well-defined internally, contrasting with ground color.
m. Wing purple before the fascia, brown beyond. 22. **altella**
mm. Wing not as above.
n. Fascia noticeably beyond the middle.
o. Fascia indistinct ..18. **obscurella**
oo. Fascia distinct.
p. Wing brown with bronzy and purple reflections.
q. Entire tuft ochraceous. 19. **ostryaefoliella**
qq. Tuft ochraceous behind only. 20. **paludicola**
pp. Wing bluish black ..21. **myricafoliella**
nn. Fascia at or near the middle.
o. Tuft black ..25. **quercipulchella**
oo. Tuft reddish or ocherous.

p. Ground color bronzy.
q. Collar pale yellowish (usually) 24. **opulifoliella**
qq. Collar not pale....23. **corylifoliella**
pp. Ground color purplish black.
q. Legs reddish yellow. 26. **condaliafoliella**
qq. Legs silvery and fuscous. 27. **juglandifoliella**
kk. With additional silvery or golden markings.
l. A semi-elliptical golden metallic spot on dorsum proximal to fascia.....12. **rhoifoliella**
ll. Metallic markings along termen or at apex.
m. Termen margined with silvery scales from dorsum to apex.....13. **terminella**
mm. Apex golden metallic, concolorous with fascia.....14. **villosella**

aa. Fore wings without pale spots or fasciae.
b. Ground color pale ocherous or yellowish.
c. A purplish fuscous band across apex of fore wing.
d. Fore wing dusted with fuscous scales.
e. A dark brown spot at base of dorsal margin.51. **nigriverticella**
ee. No such spot.....52. **populetorum**
dd. Fore wing not dusted.....50. **crataegifoliella**
cc. No such band; wing dusted.
d. Tuft fuscous or blackish.....53. **saginella**
dd. Tuft ocherous.....54. **pallida**
bb. Ground color gray, brown or bronzy.
c. Ground color pale gray.
d. Wings evenly dusted with fuscous.....46. **punctulata**
dd. Wings not dusted; a fuscous spot in apex....48. **belfrageella**
cc. Wings brown, usually with purple or bronzy luster.
d. Size large (9 mm.).....47. **grandisella**
dd. Not exceeding 6 mm. expanse.
e. Fore wing with metallic bronzy or golden reflections.
f. Wing deep reddish or purplish bronzy.....42. **pomivorella**
ff. Wing paler, with greenish golden reflections....43. **chalybeia**
ee. Fore wing dark brown, with faint purple reflections.
f. Tarsi of middle and hind legs pale ocherous..44. **flavipedella**
ff. Tarsi of middle and hind legs whitish..45. **castaneaefoliella**

1. **Nepticula argentifasciella** Braun

*Nepticula argentifasciella* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 100, (1912).

Palpi black. Tuft black behind, ochraceous in front. Antennae black, eye-caps silvery white. Thorax and base of fore wings dark purple. Fore wings dark brown, with metallic reflections when viewed obliquely. At the basal fifth of the wing there is a brilliant silvery fascia, becoming decidedly

broader as it nears the dorsum; sometimes it broadens so considerably as almost to reach the base of the wing. At the middle of the wing is a second fascia, in some specimens almost wedge-shaped, with its base resting on the dorsum. At the extreme apex of the wing is a silvery patch of scales of variable extent; in some cases it extends from the costa around the apex broadening toward the tornus, and occasionally it is connected along the dorsum by a few silvery scales with the second fascia; sometimes it is reduced to a rather large spot at the tornus. The color of these fasciae varies considerably, depending on the direction of the light, either silver, or when viewed very obliquely, a metallic pale blue. Cilia dark brown. Hind wings and cilia dark brown. Legs black, fore and middle tarsi and last segment of the hind tarsi buff. Abdomen black above, sometimes silvery beneath.

Expanse—4 to 4.5 mm.

*Localities.*—Cincinnati, Ohio; Powell County, Kentucky.

The larva is a miner in leaves of basswood (*Tilia americana*). The egg is deposited on the upper surface of the leaf, but the larva upon hatching mines much closer to the lower than to the upper epidermis, forming at first a very narrow serpentine mine (Fig. 32) about 3.5 to 4 cm. in length, with a width nowhere greater than .5 mm. This portion of the mine is scarcely visible from the upper side, except for the tiny specks of leaf substance consumed here and there. Within the last twenty-four or thirty-six hours of larval life the linear mine suddenly expands into a blotch, 3.5 to 4 mm. in breadth. In this area, which often obliterates part of the early serpentine mine, the mine is semi-transparent and pale green. The larva spins a somewhat flattened reddish cocoon, broader at its anterior end.

There are two or three generations a year; larvae become full grown toward the end of June, in August and the latter part of September.

2. **Nepticula scintillans** new species

Palpi whitish. Tuft and collar black; eye-caps silvery white. Thorax and base of fore wing golden. Fore wing, except at the base, very dark purple with a silvery fascia across the middle, broadest on the dorsal margin. A second silvery fascia crosses the apex of the wing. At the extreme apex the cilia are dark brown, elsewhere silvery gray. Hind wings and cilia gray. Legs gray, with paler tarsi. Abdomen black, silvery beneath.

Expanse—3 mm.

*Locality.*—Cincinnati, Ohio.

*Type material.*—Holotype (writer's collection); paratype (Acad. Nat. Sci. Phila); three paratypes (writer's collection).

Five specimens, bred from narrow linear mines on hawapple (*Crataegus mollis*). The mine (Fig. 11) is a tortuous serpentine tract, soon becoming brownish, and rarely exceeding 1 mm. in breadth at its end. The cocoon is dark brown.

Larvae may be found in June, and in July and early August. The second generation of larvae usually overwinters, but occasionally larvae of a third generation are found in late August.

3. **Nepticula pteliaecella** Chambers

*Nepticula pteliaecella* Chambers, Psyche, iii, 137, 1880; 276, 1881; Dyar's No. 6214.

Tuft on head dark brown; eye-caps white. Thorax and base of fore wing at the dorsum silvery; a silvery fascia before the middle, a costal and opposite dorsal spot at three-fourths, on a dark brown ground color. Cilia silvery around the apex, becoming brown toward the dorsum. Hind wings and cilia dark brown. Legs brown outwardly, inner surfaces and apical segments of tarsi silvery. Abdomen dark brown above, paler beneath.

*Expanse*—4 to 4.5 mm.

*Localities.*—Kentucky (Chambers); Ohio.

The larvae is a miner in leaves of hop tree (*Ptelea trifoliata*). The egg is deposited on the upper side of the leaf; the mine (Fig. 12) which is everywhere much contorted, is at first very indistinct, and sometimes blotch-like; later it becomes more distinct, but is more or less obscured by the scattered frass. Deserted mines become whitish or yellowish. The larva is a very bright green in color. Cocoon dark brown.

Two generations a year; larvae may be collected in July and in August and September.

4. **Nepticula quadrinotata** new species

Head dark brown; eye-caps silvery white. Thorax and fore wings dark brown; markings silvery white, consisting of an elongate spot at base of dorsum, a small spot on the costa before the middle, a larger triangular spot at the tornus, and a similar spot on the costa nearer the apex. Cilia brown, with silvery tips around the apex. Hind wings and cilia brown. Legs grayish iridescent. Abdomen brown above, silvery beneath.

*Expanse*—4 to 5 mm.

*Localities.*—Cincinnati, Ohio; Fairfield County, Ohio; Powell County, Kentucky.

*Type material.*—Holotype (writer's collection); paratype (Acad. Nat. Sci. Phila.); six paratypes (writer's collection).

The larva, which is very pale green with a brighter green line of ingested food, mines leaves of hornbeam (*Carpinus caroliniana*)

and hazel (*Corylus americana*). The mine (Fig. 13) for the first 3 or 4 cm. of its length is a very fine linear one, usually closely following the midrib or one of the lateral veins; later doubling on itself for a short distance before it expands into an irregular pale brownish blotch, which may occupy the entire space between two lateral veins. The blotch often obliterates the earlier linear mine. Cocoon brownish, usually with an olive green tinge.

Two generations a year; mines in July and from late August to the middle of October, but never common.

A very distinct species. The mine should not be confused with that of *N. ostryaefoliella* Clemens on hop hornbeam and birch, which is linear, gradually increasing in breadth throughout.

5. **Nepticula trinotata** Braun

*Nepticula trinotata* Braun, Can. Ent., xlvi, 18, 1914.

Palpi very pale ocherous. Tuft ocherous. Antennæ fuscous, eye-caps whitish. Thorax with deep blue reflections. Fore wings with deep blue reflections in the basal third, velvety black beyond and somewhat irrorated in the apical third, the scales here having pale bluish iridescent bases. At the basal third on the costa is a white spot of variable size, faintly tinted with lilac in some lights. At the apical third there is a costal and an opposite dorsal spot, each shining white and larger than the spot at the basal third. The costal spot is usually more oblique, its tip extending outwardly beyond the opposite dorsal spot. Cilia almost entirely pure white. Hind wings and cilia pale silvery gray. Legs pale grayish ocherous, tarsal joints dark tipped. Abdomen purplish fuscous above, paler and iridescent beneath in the female.

*Expanse.*—4.5 to 5 mm.

*Localities.*—Cincinnati, Ohio, and vicinity.

The larvae form blotch mines on *Carya cordiformis* (*Hickoria minima*) and occasionally on *C. ovata*. The mine (Fig. 33) is at first an extremely narrow linear tract, later suddenly expanding into a broader tract, 1 mm. or more in width, which in turn becomes a blotch, varying in width from 3 to 6 mm. The mine is almost transparent even in the early linear portion, which thus distinguishes it from that of *N. juglandifoliella* Clemens on hickory. This is the large blotch mine to which Chambers refers[6].

[6] Psyche, iii, 66, 1880.

The larva is of a dull grayish color. Cocoon reddish brown.

There are two generations a year, the mines of the first appearing during the early part of July and those of the second generation at the beginning of September.

6. **Nepticula ceanothi** Braun

*Nepticula ceanothi* Braun, Ent. News, xxi, 172, 1910.

Tuft ochraceous; eye-caps shining creamy buff. Thorax and basal third of fore wing bronzy with purple and blue reflections. A shining golden fascia at one-third and a second similar fascia at two-thirds; beyond the first fascia the ground color of the wing is dark brown. Cilia brown, pale iridescent gray toward their tips. Hind wings and cilia brownish gray. Upper surface of abdomen dark brown; lower surface of body and legs metallic gray with bronze reflections.

*Expanse.*—4.5 to 5 mm.

*Localities.*—Dutch Flat, Placer County, California (G. R. Pilate); Eureka, California (Barber); Mt. Lowe, California.

The larva mines leaves of *Ceanothus divaricatus*, forming a narrow brownish contorted tract (Fig. 14), about 3 cm. in length, with a breadth of 1 mm. at the end and almost filled with frass.

Cocoon red dishbrown. The type specimens were bred from mines received from Dutch Flat, California, in February; imagoes in March and April.

The mines occur in great numbers on the same plant in southern California.

7. **Nepticula bifasciella** Clemens

*Nepticula bifasciella* Clemens, Proc. Ent. Soc. Phila., i, 133, 1862; Tin. No. Am., 183, 1872; Busck, Proc. Ent. Soc. Wash., v, 209, 1903; Dyar's No., 6188.

Syn. *serotinaeella* Chambers, Can. Ent., v, 126, 1873; Dyar's No. 6221.

Tuft ochraceous; eye-caps shining cream color. Thorax and base of fore wings to the first fascia dark purple; beyond the first fascia the wings are dark brown with bronzy reflections; the fasciae are silvery or golden according to the light, the first fascia at one-third, the second at two-thirds of the wing length. Cilia concolorous, becoming silvery at their tips. Hind wings and cilia gray.

*Expanse.*—4 to 4.5 mm.

*Localities.*—Pennsylvania (Clemens); Kentucky (Chambers); Ohio.

The larva is a miner in leaves of wild cherry (*Prunus serotina*), and occasionally on wild plum (*Prunus americana*). The mine (Fig. 15) is much contorted, especially at first, often by confluence forming a blotch, later distinct, with the frass scattered to near the the end, where it is collected into a broad line. The leaf of wild cherry is discolored and reddish around the mine. Cocoon ocherous, sometimes reddish.

This species is one of the earliest to appear in the spring; larvae become full grown by the middle of May; later generations occur in June and July and in September. The mines are especially common on the leaves of young saplings a few inches above the ground.

The name *prunifoliella* used by Clemens in referring to the empty mines of this species is a *nomen nudum*.

8. **Nepticula intermedia** new species

Head black; eye-caps silvery white. Thorax bronzy, base of fore wings plum-purple, followed by a shining silvery or golden fascia. Beyond this fascia the wing is dark brown, with but faint bronze reflections. A second silvery or golden fascia crosses the wing at two-thirds. Cilia silvery around the apex. Hind wings and cilia gray, with faint purple metallic reflections. Legs black.

*Expanse.*—3 to 3.5 mm.

*Localities.*—Cincinnati, Ohio; Kentucky.

*Type material.*—Holotype (writer's collection); paratype (writer's collection).

Two specimens bred from serpentine mines (Fig. 16) on leaves of sumac (*Rhus* spp.). The loosened epidermis is bright green at first, later yellowish, and is marked by a broad blackish frass line nearly as broad as the mine. Larva very bright green. Usually there are but two generations a year, larvae maturing in July overwintering, but occasionally a third generation appears. Chambers makes brief mention of these mines on sumac.[7]

9. **Nepticula diffasciae** Braun

*Nepticula diffasciae* Braun, Ent. News, xxi, 172, 1910.

Tuft ochraceous; eye-caps and collar creamy white. Thorax and fore wings brownish black, the latter irrorated in the apical third. There are two pale fasciae; the first at one-third is creamy buff, the second at two-thirds is white, more shining and usually narrower than the first. Cilia whitish around the apex, gray at the tornus. Hind wings and cilia brownish. Abdomen brown at the base, dark gray behind. Legs brownish.

*Expanse.*—5.5 to 5.8 mm.

*Locality.*—Dutch Flat, Placer County, California (Pilate).

The mine (Fig. 17) on the upper side of leaves of an unidentified shrub, is a long tortuous tract, almost indistinguishable at first, later semitransparent, with scattered frass. The end of the mine is whitish and almost transparent. The cocoon is of a sordid

[7] Psyche, iii, 66, 1880.

yellowish color. The mines from which the type series was reared were collected in March and produced imagoes in May.

10. **Nepticula rhamnicola** Braun

*Nepticula rhamnicola* Braun, Ent. News, xxvii, 56, 1916.

Syn. *rhamnella* || Braun (not Herr.-Sch.), Journ. Cin. Soc. Nat. Hist., xxi, 96, 1912.

Tuft ocherous in the summer generation, black in the overwintering generation. Antennae black narrowly ringed with pale gray, eye-caps creamy buff. Thorax creamy buff, patagia dark brown. Fore wings brown, the tips of the scales blackish. At the basal third of the wing is a cream colored fascia with its edges often indented by dark scales. At two-thirds of the wing length is a more shining silvery fascia. Cilia pale gray, whitish around the apex. Hind wings and cilia gray. Fore and middle pair of legs ocherous, somewhat shaded with gray, hind pair predominantly gray. Abdomen brown above, paler beneath.

*Expanse.*—4.5 to 5.5 mm.

*Locality.*—Ohio, along little Miami River.

The mines (Fig. 35) are very common in leaves of *Rhamnus lanceolata* growing along the banks of the little Miami River in Hamilton and Clermont Counties, Ohio. The egg is deposited on the underside of the leaf, and the larva upon hatching makes a short contorted mine within a small area, so that its presence is indicated from above by a blackish discolored spot on the leaf; the mine then extends as a fine line nearly straight for a distance of about 1.5 cm.; during this time it is not visible on the upper surface of the leaf. The larva then crosses to the upper surface, continuing the linear mine for a distance of about 1. 5 cm. further. The mine now suddenly expands into a broader tract or blotch, and from thence to its end has a width of from 2 to 3 mm. The length of the broad tract is about 2 cm. and in it nearly the entire leaf substance is consumed. The formation of the blotch occupies approximately the last two days of the larval period within the mine. Larva bright green; cocoon tawny.

There are three generations a year; mines are most abundant in October.

This species may be distinguished from its nearest ally, *N. diffasciae*, by its whitish thorax.

11. **Nepticula cerea** new species

Head buff; eye-caps a little paler. Thorax and base of fore wings to just beyond one-third, creamy buff. From the base a few fuscous scales extend along the costa to the middle of the pale area, where they join a small triangular

fuscous spot which is sometimes faintly connected with the dorsum by a few scattered fuscous scales. Following the pale basal area, a broad dark brown band crosses the wing, succeeded by a narrower silvery white fascia. The apical third of the wing is dark brown, except the cilia at the apex which are pure white. Hind wings and cilia gray. Legs buff, except posterior tibiae and basal segments of tarsi which are fuscous. Abdomen fuscous above, buff beneath.

*Expanse.*—3.5 mm.

*Localities.*—Cincinnati, Ohio, June 15 and August 28; Oak Station, Allegheny County, Pennsylvania (Marloff), May 25.

*Type material.*—Holotype (writer's collection); paratype (writer's collection); paratype (Marloff collection).

12. **Nepticula rhoifoliella** Braun

*Nepticula rhoifoliella* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 93, 1912.

Head black; eye-caps silvery white. Thorax blackish purple. Fore wings very lustrous, base of the costa plum-purple. A large semi-elliptical patch of scales just beyond the base of the wing and resting on the dorsum, but not reaching to the extreme costa, is deep brilliant golden, shading along its edges into reddish bronze. This golden patch, while it does not constitute a definitely limited marking, is nevertheless distinctly differentiated from the rest of the wing. Beyond this the wing is deep purple with bronze reflections, crossed at three-fifths by a straight shining silvery or pale golden fascia. Cilia of the general hue, the tips but little paler around the apex. Hind wings and cilia gray. Legs black, except the tibiae and tarsi of the middle pair, which are silvery. Abdomen blackish above, somewhat paler beneath.

*Expanse.*—3.5 mm.

*Localities.*—Ohio; Kentucky; St. Louis, Missouri (Miss Murtfeldt).

The larvae make contorted serpentine mines (Fig. 34) on the upper side of leaves of poison ivy (*Rhus toxicodendron*). The loosened epidermis is pale brownish yellow and the frass is dispersed, in most places, throughout the entire breadth of the mine. Cocoon brown.

There are three generations; mature larvae may be found in June, toward the end of July and in September.

This species is very distinct from any other species. The golden patch of scales, standing out even to the naked eye as paler and more lustrous than the remainder of the wing, immediately identifies it.

13. **Nepticula terminella** Braun

*Nepticula terminella* Braun, Can. Ent., xlvi, 23, 1914.

Tuft on the face dull brownish, on the vertex and head black; color and eye-caps shining white, with a very faint yellow tinge. Thorax bronzy. Costal half of the fore wing to the fascia, blue-purple, the blue predominating at the extreme edge; below the costa the wing shades into a deep brilliant golden color, becoming more bronzy as it nears the fascia. The fascia is situated just beyond the middle of the wing, is almost straight and has a brilliant silvery luster. Apical third of the wing blue-purple, blue predominating. Just below the apex a double row of silvery scales margins the termen, becoming a single row toward the dorsum and sometimes connected with the fascia. Cilia gray. Hind wings and cilia gray, with a purple tinge. Legs dark gray, tibiae and tarsi of the fore pair and tarsi of the others, ocherous. Abdomen dark purplish gray above, yellowish beneath toward the tip, anal tuft yellow.

*Expanse.*—5 to 5.5 mm.

*Localities.*—Ohio; Kentucky; Oak Station, Pennsylvania (Marloff).

The mine (Fig. 36) occurs on various species of oak, most commonly on red oak (*Quercus rubra*) and pin oak (*Q. palustris*). It is a pale greenish, gradually broadening linear tract, 3.5 mm. wide at the end (being thus broader than any except the true blotch mines on oak), with a blackish line of frass through the center. Larva yellow even when very young; thus this mine can early be distinguished from the other linear mines on oak. Cocoon ocherous to brown.

There are three generations a year, and in favorable seasons, a fourth. Mines containing full-grown larvae may be collected in the middle of June, the latter part of July, the end of August and beginning of September, and during October and early November.

14. **Nepticula villosella** Clemens

*Nepticula villosella* Clemens, Proc. Ent. Soc. Phila., i, 84, 1861; Tin. No. Am., 174, 1872; Braun, Journ. Cin. Soc. Nat. Hist., xxi, 94, 1912; Dyar's No. 6224.

Syn. *dallasiana* Frey and Boll, Stett. Ent. Zeit., xxxvii, 228, 1876; Dyar's No. 6195.

Tuft orange-ochraceous; eye-caps pale golden. Thorax and fore wings to the fascia brilliant metallic bronzy, somewhat purple at the base of costa; fascia at two-thirds golden. Wing beyond the fascia blue-purple, with a large spot at the apex and the apical cilia golden, concolorous with the fascia. Hind wings and cilia gray. Legs black, posterior tarsi silvery. Abdomen black.

*Expanse.*—4.5 mm.

*Localities.*—Pennsylvania (Clemens); Texas (Boll); Ohio; Kentucky.

The larva is a miner in leaves of blackberry (*Rubus* spp.) and occasionally wild raspberry (*Rubus occidentalis*). The mine (Fig. 18) is a tortuous brown linear tract, scarcely broader than the pale brownish larva within. Cocoon brownish.

Three generations; mature larvae are found in the latitude of Cincinnati in the middle of June, latter part of July and in October.

Distinguished from all other species by the metallic golden apex.

15. **Nepticula resplendensella** Chambers

*Nepticula resplendensella* Chambers, Cin. Quart. Journ. Sci., ii, 118, 1875; Dyar's No. 6217.

Palpi whitish, tuft pale reddish saffron. Fore wings, including cilia with a brilliant metallic luster, golden or silvery, except the basal half of the costal margin, and a large spot extending along the base of the costal cilia nearly to the tip and more than half way across the wing, which are deep purple. Tips of tarsi pale yellowish.

*Expanse.*—6 mm.

*Locality.*—Kentucky (Chambers).

The above description is compiled from Chambers' diffuse description of this species. I have not taken the species nor examined the type, but it is very close to the following species, if not identical with it.

16. **Nepticula unifasciella** Chambers

*Nepticula unifasciella* Chambers, Cin. Quart. Journ. Sci., ii, 119, 1875; Journ. Cin. Soc. Nat. Hist., ii, 193, 1880; Dyar's No. 6223.

Head orange-ochraceous; eye-caps silvery white. Upper surface of thorax and basal two-thirds of fore wing brilliant metallic bronzy or golden, except toward the costal margin where the color shades into purple, so that a silvery or golden fascia at the apical third is scarcely defined internally. Behind the fascia, the wings are deep purple. Cilia purple, golden at their tips. Abdomen, legs and under side of wings shining brownish black.

*Expanse.*—4.5 mm. (Chambers)

*Localities.*—Kentucky (Chambers); Texas (Chambers); Cincinnati, Ohio.

Specimens in my collection answer Chambers' description in every respect, but vary in expanse from 5 mm. (male) to 7 mm. (female). The larva is probably an oak miner. Moths were collected in the middle of June resting on leaves of red oak.

17. **Nepticula purpuratella** new species

Tuft ochraceous or orange; eye-caps silvery white. Thorax deep bronzy or golden. Extreme base of the fore wing concolorous with the thorax, shading outwardly to a paler lustrous golden color, which at the outer limits of the basal third is followed by a deep bronzy band with purple and reddish reflections varying in intensity, and occupying approximately the middle of the wing. This is followed by a brilliant silvery fascia. Apical area beyond the fascia deep bronzy, usually suffused with brilliant purple. In one specimen the purple reflections are almost entirely absent, so that the dark band preceding the fascia and the apical area are deep bronzy-golden. Cilia gray with bronzy reflections, those around the apex silvery tipped. Hind wings and cilia brownish gray. Legs brownish, with tibiae and tarsi whitish, except those of the hind pair, which are bronzy brown. Abdomen bronzy brown.

*Expanse.*—4.5 to 4.8 mm.

*Localities.*—Pittsburgh, Pennsylvania (Engel); Oak Station, Allegheny County, Pennsylvania (Marloff).

*Type material.*—Holotype (U. S. N. M.); paratype (writer's collection); paratype (Marloff collection).

Three specimens, collected in May and early June. The only American species, thus far known, in which the fascia is preceded by a dark band separating it from the paler basal area.

18. **Nepticula obscurella** Braun

*Nepticula obscurella* Braun, Journ. Cin. Soc. Nat. Hist., xxi. 95, 1912.

Tuft ocherous. Antennae brownish, eye-caps whitish. Thorax brown. Fore wings shining golden brown, tinged with bronze along the extreme costa and in the apex. Just beyond two-thirds of the wing-length there is an indistinct narrow whitish fascia, broadest in the middle of the wing and fading out toward the ends. When viewed at some angles this fascia is scarcely visible. Cilia of the general hue, their tips around the apex paler and concolorous with the fascia. Hind wings grayish brown. Legs gray, tibiae and tarsi pale. Abdomen brown.

*Expanse.*—3.5 mm.

*Localities.*—Montclair, New Jersey; Long Island, New York.

The mine (Fig. 19) is a narrow serpentine track on the upper side of bayberry (*Myrica carolinensis*), with frass dispersed across the mine. Cocoon ochraceous. There are two generations a year.

19. **Nepticula ostryaefoliella** Clemens

*Nepticula ostryaefoliella* Clemens, Proc. Ent. Soc. Phila., i, 83, 1861; Tin. No. Am., 172, 1872; Dyar's No. 6208.

Tuft ochraceous; eye-caps and collar shining cream-colored. Thorax and fore wings shining brown with faint bronzy and purple reflections, which

become deeper toward the apex which is predominantly purple. At two-thirds of the wing length is a shining silvery fascia. Cilia tipped with white around the apex. Hind wings gray, with faint purple reflections. Legs and abdomen shining brown.

*Expanse.*—4 mm.

*Localities.*—Pennsylvania (Clemens); Fairfield County, Ohio; Powell County, Kentucky; Jackson County, North Carolina; Field, British Columbia.

The description is based on a specimen bred from mines collected on *Betula glandulosa* and *B. fontinalis* at Field, British Columbia, August 22, 1915. The mine (Fig. 20a) is a rather broad serpentine track, gradually increasing in breadth to the end, where it measures about 2 mm. across, with a line of frass through the middle. The length of the mine varies with the species of birch; on the thin-leaved *Betula lenta* (Fig. 20b) it is sometimes twice as long as it is on thick-leaved species, and attains the maximum breadth of 2 mm. several centimeters before the end; often the frass is scattered across the mine for part of its length. Similar mines occur also on *Betula lutea*, but I have never seen this mine on *Ostrya*, where Clemens found it, whence the name *ostryaefoliella* given to the larva. The cocoon is reddish brown. There are two generations in the south, one in the north.

The moth is very similar to the preceding species, but has a more distinct fascia and pale collar.

20. **Nepticula paludicola** new species

Tuft clay-colored or fuscous on the face, shading to buff or ochraceous on the head; eye-caps and collar shining cream-colored. Thorax and base of fore wings shining deep golden with purple reflections; the purple reflections become more pronounced outwardly, so that the apical area of the wing beyond the fascia is deep purple, with the golden color showing only at the bases of the scales. A silvery or golden fascia at nearly two-thirds the wing length. Cilia concolorous with the wing; their tips silvery around the apex. Hind wings gray. Legs shining brown outwardly, silvery beneath, with the posterior tarsal segments paler, sometimes the last two or three ochraceous.

*Expanse.*—3.5 to 4.5 mm.

*Localities.*—New Jersey, at Retreat, Pemberton, New Lisbon and White's Bog (H. B. Scammell).

*Type material.*—Holotype (U. S. N. M.); three paratypes (U. S. N. M.)

Four specimens, in the National Museum collection, bred from mines on leaves of cranberry (*Oxycoccus macrocarpus*). The mine (Fig. 21) is a serpentine track, closely following the margin of the leaf for the greater part of its length; it is sometimes bent back on itself, but then the two parts are contiguous. Cocoon ocherous. The imagoes appeared in May and July.

This species is closely allied to *N. ostryaefoliella* in which, however, the entire tuft is ochraceous and the fascia is a little more posterior.

21. **Nepticula myricafoliella** Busck

*Nepticula myricafoliella* Busck, Proc. U. S. Nat. Mus., xxiii, 238, 1900; Dyar's No. 6204.

"Antennae silvery fuscous, extreme tip white. Face and head tufted, light golden yellow. Eye-caps silvery white. Thorax and fore wing deep bluish black with strong metallic reflections. At two-thirds from base is a transverse, silvery white fascia, a little broader on the dorsal than on the costal edge. Dorsal cilia at the fascia white; rest of cilia dark purplish gray. Hind wing light gray. Abdomen shining black above, silvery below. Legs purplish. All tarsi white.

"Alar expanse, 2.8 mm."

*Locality.*—Florida (Dyar).

The specimens, from which the above description by Mr. Busck was made, were bred from upper serpentine mines on *Myrica cerifera*. The mine (Fig. 22) is extremely narrow, measuring scarcely 1 mm. across at the extreme end where the larva makes its exit.

22. **Nepticula altella** Braun

*Nepticula altella* Braun, Can. Ent., xlvi, 21, 1914.

Tuft orange-ochraceous in front, becoming pale behind. Antennae fuscous, eye-caps creamy white. Thorax dark purplish brown. Fore wings before the fascia purple brown, beyond it brown with purple reflections; the general color to the naked eye is deep purple before the fascia and brown beyond it. A silvery fascia crosses the wing at three-fifths, and is usually a little broader on the margins of the wings. Cilia gray, hind wings deep purple, becoming brown toward the tip. Legs fuscous, tarsi of the middle and hind pair silvery. Abdomen purplish brown.

*Expanse.*—6.5 to 7 mm.

*Locality.*—Southwestern Ohio, locally in pin oak forests.

The species has but one generation a year; moths appear in May. The mines occur on the first leaves of the pin oak (*Quercus palustris*) that appear in the spring, never on the leaves that come

later. The mine (Fig. 37), which may best be regarded as a lower side mine, is at first much contorted, winding and twisting within a small area, causing a brownish discoloration of the surrounding leaf. This portion of the mine seems to be formed early in the season, and the leaf around it is always dead when further feeding is resumed in October, and the larva starts out to mine into the fresh green portion of the leaf where the mine is more distinct, due to partial eating of the leaf substance. The larva then becomes full fed in a week or ten days and leaves the mine to spin a dark brown cocoon. The mine is extremely long but measures only 1 to 1.5 mm. in width at its end. Larva yellow, with a row of dark brown dashes along the mid-ventral line.

This species may be separated from all other species by the fact that the wing is purple before the fascia and brown beyond, the reverse being true in all other cases where there is a difference in color before and behind the fascia.

23. **Nepticula corylifoliella** Clemens

*Nepticula corylifoliella* Clemens, Proc. Ent. Soc. Phila., i, 83, 1861; Tin. No. Am., 172, 1872: Braun, Journ. Cin. Soc. Nat. Hist., xxi, 91, 1912; Dyar's No. 6193.

Syn. *virginiella* Clemens, Proc. Ent. Soc. Phila., i, 83, 1861; Tin. No. Am., 172, 1872; Braun, Journ. Cin. Soc. Nat. Hist., xxi, 90, 1912; Dyar's No. 6225; *minimella* Chambers, Can. Ent., v, 127, 1873; Dyar's No. 6203.

Tuft ocherous to orange-ochraceous. Eye-caps silvery white, sometimes shading to fuscous outwardly. Thorax and fore wings bronzy brown, with blue-purple reflections toward the costa and in the entire apical part of the wing beyond the fascia, where the color is then predominantly purple. Sometimes the purple reflections are entirely lacking proximal to the fascia. The fascia is situated just beyond the middle of the wing, rather broad, narrowing toward the costa. Cilia silvery-tipped at the apex. Hind wings and cilia gray, with purple reflections. Legs purplish black, except middle pair and tarsi which are silvery. Abdomen above purple, silvery iridescent beneath.

*Expanse*.—3.5 mm.

*Localities*.—Pennsylvania (Clemens); Kentucky (Chambers); Ohio; Plummer's Island, Maryland (Busck).

*Food plants*: hazel (*Corylus americana*), hop hornbeam (*Ostrya virginiana*), hornbeam (*Carpinus caroliniana*) and black birch (*Betula lenta*). The mine (Fig. 40) is a long, very narrow winding tract scarcely broader than the larva, with frass collected into a central line or dispersed across the mine. Larva

pale green. Cocoon brown. Larvae may be found in June and early July, and from late August until October.

Although specimens bred on hazel are usually darker than those from other food plants, there is sufficient range of variation in color among specimens bred from any one of the other food plants, to justify the conclusion that all are conspecific.

24. **Nepticula opulifoliella** Braun

*Nepticula opulifoliella* Braun, Can. Ent., xlvi, 22, 1914.

Tuft ochraceous; color usually pale yellowish; eye-caps pale shining buff, sometimes fuscous outwardly. Thorax dark fuscous, with purple and blue reflections. Fore wings with pronounced purple and blue reflections toward the costa and beyond the fascia, shading to bronzy green below the fold. At three-fifths is a broad very shining silvery fascia with faint golden luster. Cilia gray, extreme tips pearly white. Hind wings and cilia gray. Legs dark fuscous, except the middle pair, which are silvery. Abdomen purplish fuscous above, paler beneath in the female.

*Expanse.*—3.5 to 4 mm.

*Localities.*—Cincinnati, Ohio; Balsam, North Carolina.

The larvae form brownish, much contorted serpentine mines (Fig. 38) in leaves of Opulaster (*Physocarpus opulifolius*). Larva yellowish; cocoon reddish brown. Two generations; larvae in July and September.

This species is very close to *N. corylifoliella*, from which it is difficult to distinguish it. The pale collar when present is a reliable character. The more yellowish eye-caps, less lustrous wing with absence of reddish tints, will aid in separating this species from *N. corylifoliella*.

25. **Nepticula quercipulchella** Chambers

*Nepticula quercipulchella* Chambers, Bull. Geol. Surv. Terr., iv, 105, 1878; Dyar's No. 6216.

Head black; color and eye-caps yellowish white, silvery; thorax and fore wings deep blue black, bronzed and with purple and violet reflections; the fascia is behind the middle, silvery white and a little widest on the dorsal margin, and the wing behind the fascia is darker than before it, whilst the cilia are paler and less lustrous than the wing. Under surface of wing, abdomen and legs cupreous black.

*Expanse.*—4 mm.

*Locality.*—Kentucky (Chambers).

The above description is essentially that given by Chambers. According to him "the larva is bright green, with a deeper green line of contents; it makes a long narrow, winding, and gradually

widening track, similar to that of *N. quercicastanella* Chambers in leaves of *Quercus alba.*" Chambers asserts that the larva from which he bred the type specimen formed a new mine when nearly grown, a fact if true at variance with all observations on this group.

Except for the absence of silvery scales along the termen, the moth is very close to *N. terminella.* The green color of the larva, however, precludes the possibility of their identity.

26. **Nepticula condaliafoliella** Busck

*Nepticula condaliafoliella* Busck, Proc. U. S. Nat. Mus., xxiii, 238, 1900; Dyar's No. 6192.

"Face and head tufted, reddish yellow, eye-caps shining white. Antennae dark fuscous. Thorax and fore wing deep black with purplish metallic reflections; just beyond the middle of wing is a transverse silvery white fascia, a little broader on the dorsal margin than on the costal. Cilia at apex white; dorsal cilia light purplish-gray, concolorous with hind wing. Abdomen black above, silvery below; anal tuft silvery white. Legs reddish yellow.

"Alar expanse, 3.1 mm."

*Locality.*—Palm Beach, Florida (Dyar).

The moths were bred in February from upper side mines on leaves of *Condalia ferrea.* "Egg is deposited on underside of leaf near edge, and the mine is a contorted serpentine with black frass in a continuous central line. Cocoon is chestnut brown, 1.6 by 1 mm."

27. **Nepticula juglandifoliella** Clemens

*Nepticula juglandifoliella* Clemens, Proc. Ent. Soc. Phila., i, 84, 1861; Tin. No. Am., 173, 1872; Chambers, Bull. Geol. Surv. Terr., iv, 105, 1878; Braun, Journ. Cin. Soc. Nat. Hist., xxi, 91, 1912; Dyar's No. 6199.

Syn. *caryaefoliella* Clemens, Proc. Ent. Soc. Phila., i, 84, 1861; Tin. No. Am., 174, 1872; Dyar's No. 6190.

Tuft ochraceous, eye-caps and collar shining creamy white. Thorax and fore wings deep purplish black, uniformly purple beyond the fascia which is situated just beyond the middle, silvery white and broadest on the dorsum. Cilia silvery around the apex, elsewhere concolorous with the wings. Hind wings and cilia gray. Legs silvery white, except the upper surface of the posterior femora and tibiae, which are purplish black. Abdomen purplish above, silvery beneath.

*Expanse.*—3.5 to 3.8 mm.

*Localities.*—Pennsylvania (Clemens); Kentucky (Chambers); Ohio.

The mine (Fig. 39) is a serpentine track usually whitish, with black line of frass through the center, found on various species

of hickory and on walnut and butternut. The larva is pale green (almost white when feeding on walnut). Cocoon brownish red.

There are three generations; full grown larvae may be found in the middle of June, latter part of July, and in late August and early September.

The purple fore wings and white collar separate this species from its nearest allies.

28. **Nepticula apicialbella** Chambers

*Nepticula apicialbella* Chambers, Can. Ent., v, 127, 1873; Braun, Can. Ent., xlvi, 21, 1914; Dyar's No. 6185.

Syn. *leucostigma* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 88, 1912.

Tuft ochraceous, collar creamy white. Antennae dark brown, faintly annulate with a paler shade; eye-caps white. Thorax dark purplish brown. Fore wings dark brown, with a faint purple luster. Beyond the middle of the wing there is a narrow, oblique white fascia, convex outwardly and reaching the margin farther from the base on the dorsum. The scales at the extreme tip of the wing are white, forming with the whitish apical cilia, a very distinct pale patch. The cilia except at the apex as just described, are gray. Hind wings and cilia dark gray. Legs shining grayish ocherous, hind femur creamy white, hind tarsi dark gray. Abdomen dark purplish above, pale beneath.

*Expanse.*—4 mm.

*Localities.*—Kentucky (Chambers); Ohio.

The larvae make upper side serpentine mines on red elm, white elm and cork elm (*Ulmus fulva*, *U. americana* and *U. racemosa*). The mine (Fig. 43) is brownish in color with a conspicuous line of frass through the middle. Cocoon reddish brown.

Three generations; full grown larvae in mid-June, late July and in August and September.

The oblique fascia and white apex distinguish this species from all others.

29. **Nepticula tiliella** Braun

*Nepticula tiliella* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 90, 1912.

Tuft ochraceous, collar white. Antennae black, eye-caps shining white. Thorax black. Fore wings almost black, with a very faint purple luster. There is a shining pure white fascia, slightly oblique and a little convex outwardly, at the middle of the wing. Cilia gray on the dorsum, shining white from the tornus to the costa. Hind wings and cilia gray. Legs silvery gray, tinged with ocher, hind tibiae and tarsi blackish above. Abdomen blackish above, silvery gray beneath.

*Expanse.*—3.5 mm.

*Localities.*—Ohio; Kentucky.

Larvae in serpentine mines on the upper side of leaves of basswood (*Tilia americana*); the mine (Fig. 41) is characterized by the tendency toward a spiral form, with either the early or later portion inside; and the frequency of angular turns. Cocoon brownish red.

Two generations; full grown larvae in early July and late August.

The pure white fascia and the white cilia against which the outermost row of black scales is sharply defined, distinguish this species.

30. **Nepticula rubifoliella** Clemens

*Nepticula rubifoliella* Clemens, Proc. Acad. Nat. Sci. Phila., 1860, 214; Tin. No. Am., 152, 1872; Busck, Proc. Ent. Soc. Wash., v, 208, 1903; Dyar's No. 6219.

Head ocherous; eye-caps silvery white. Thorax and fore wings almost black, with a shining silvery or faintly golden fascia at the middle of the wing; the fascia is convex outwardly and somewhat narrowed in its middle, sometimes almost interrupted. Cilia whitish, so that the marginal line of scales is defined. Hind wings and cilia gray. Legs silvery as is also the underside of the abdomen.

*Expanse.*—4 mm.

*Localities.*—Pennsylvania (Clemens); Ohio; Kentucky.

The larvae mine leaves of blackberry, forming at first very narrow linear mines, which closely follow a vein or the margin of the leaf before enlarging into an irregular blotch (Fig. 23).

Mines containing larvae may be collected in July and September. Larva pale green; cocoon dark brown.

31. **Nepticula nyssaefoliella** Chambers

*Nepticula nyssaefoliella* Chambers, Psyche, iii, 66, 1880; Braun, Ent. News, xx, 429, 1909; Dyar's No. 6206.

Tuft ochraceous; eye-caps shining white. Thorax and fore wings black with very faint purple reflections. In the middle of the wing is a shining silvery or pale golden fascia, slightly convex outwardly. Cilia around the apex white, with marginal line of scales defined. Hind wings pale gray, with an oval patch of androconia in the male. Legs silvery gray. Abdomen purplish, silvery beneath in the male.

*Expanse.*—4.5 to 6 mm.

*Localities.*—Kentucky (Chambers); Ohio; North Carolina.

The larvae mine leaves of sour gum (*Nyssa sylvatica*), forming narrow linear mines which abruptly enlarge into blotches (Fig. 24), measuring 2 cm. or more in length, with an average width of

5 or 6 mm. Cocoon pale greenish brown. There are two or three generations a year; the larvae of the first generation become full grown in June.

This is one of the most abundant species; moths may often be collected in great numbers in the vicinity of the food plant.

From *N. rubifoliella*, its nearest ally, it is distinguished by the larger size, and equal breadth of fascia throughout.

32. **Nepticula slingerlandella** Kearfott

*Nepticula slingerlandella* Kearfott. Journ. N. Y. Ent. Soc., xvi, 187, 1908; Slingerland, Proc. N. Y. State Fruit Growers' Assoc., 122, 1909; Crosby, Bull. 308, Cornell Univ. Agric. Exp. Sta., 1911; Can. Ent., xliv, 25, 1912.

Tuft ochraceous, becoming paler behind, where it merges into the pale ocherous or whitish collar. Eye-caps white. Thorax and fore wings black with a faint bronzy luster, somewhat irrorated beyond the shining white fascia, which is situated just beyond the middle of the wing. Cilia pale gray. Legs yellowish, shaded with fuscous, especially the posterior tibiae and tarsi.

*Expanse.*—3.5 to 5 mm.

*Localities.*—New York State (Slingerland and Crosby); Ohio.

The larvae mine leaves of cultivated plums and prunes, wild plum (*Prunus americana*) and occasionally sweet cherry, forming narrow linear mines which abruptly enlarge into irregular blotches. This species attains economic importance in the plum orchards of northern New York, where its ravages have been the subject of a bulletin by Mr. C. R. Crosby, in which further details of its life history, with numerous figures, are given. There is a single generation of moths in New York, and the larvae which are full grown in July do not produce moths until the following year; in the latitude of Cincinnati a second brood of larvae may usually be collected in September.

33. **Nepticula rosaefoliella** Clemens

*Nepticula rosaefoliella* Clemens, Proc. Ent. Soc. Phila., i, 85, 1861; Tin. No. Am., 176, 1872; Braun, Journ. Cin. Soc. Nat. Hist., xxi, 89, 1912; Dyar's No. 6218.

Tuft ochraceous; eye-caps shining creamy white. Fore wings almost black, with a very faint dark blue and bronzy luster. Just beyond the middle of the wing is a rather broad straight silvery or very pale golden fascia. Cilia of the general hue, scarcely paler tipped opposite the apex. Hind wings dark gray. Fore pair of legs gray, middle and hind pair silvery, hind tibiae and tarsi black above. Abdomen black, silvery gray beneath.

*Expanse.*—4.5 mm.

*Localities.*—Pennsylvania (Clemens); Ohio.

Originally named from mine and larvae in leaves of *Rosa lucida*, it mines leaves of various species of rose, but is particularly partial to the climbing wild rose, *Rosa setigera*. The mine (Fig. 42) is serpentine usually much contorted, frequently closely following the edge of the leaf in its early course, with a broad line of frass, and measuring at its end 1.5 to 2 mm. across. Larva green. Cocoon yellowish brown, much flattened. Three generations; full grown larvae in June and early July, in August and in October; mines containing larvae may, however, be found at almost any time during the summer and fall up to November.

This species may be distinguished from *N. slingerlandella* by the darker head, dark cilia, and somewhat broader wings.

34. **Nepticula fuscotibiella** Clemens

*Nepticula fuscotibiella* Clemens, Proc. Ent. Soc. Phila., i, 133, 1861; Tin. No. Am., 182, 1872; Dyar's No. 6197.

Syn. *ciliacfuscella* Chambers, Can. Ent., v, 128, 1873; *discolorella* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 86, 1912.

Tuft ochraceous; eye-caps whitish. Thorax and fore wings fuscous, faintly purple, with the scales before the fascia paler at their bases, so that this portion of the wing is somewhat irrorated and paler than that beyond the fascia where the wing is dark fuscous purple. The fascia is just beyond the middle, dull white, sometimes a little convex and broadening on the dorsum. Cilia gray, pale gray around the apex. Hind wings gray. Legs shining gray, shaded with ocherous. Abdomen blackish above, yellowish beneath.

*Expanse.*—4 to 4.5 mm.

*Localities.*—Pennsylvania (Clemens); Kentucky (Chambers); Ohio.

The larvae mine leaves of various species of willow. The mine (Fig. 25) is a gradually broadening linear tract, sometimes straight, but often bent back on itself toward the end; occasionally (on *Salix discolor*) its latter portion is a more or less spiral blotch (Fig. 44). Cocoon ocherous or brownish. There are at least three generations a year; larvae may be collected from June until the end of October.

In spite of the difference in appearance of the mine, I am forced to conclude that *N. discolorella* is identical with *N. fuscotibiella*, since it is impossible to separate the moths.

35. **Nepticula canadensis** new species

Head black, except eye-caps and palpi which are dull white. Thorax and fore wings dull black, with a faint brownish purple tinge; an irregular dull

white fascia crosses the middle of the wing. Cilia gray. Hind wings gray. Body and legs of the same dull blackish color.

*Expanse.*—5.5 mm.

*Locality.*—Bear Creek, near Roger's Pass, British Columbia (altitude about 6000 ft.).

Holotype in writer's collection.

One specimen, bred from mines collected on leaves of alder (*Alnus tenuifolia*), August 19, 1915. A short serpentine mine abruptly enlarges into a blotch (Fig. 26), which often extends across the space between two lateral veins. Cocoon dark brown. The mines were observed only in a single locality, although common there, some leaves containing as many as a dozen mines.

36. **Nepticula ulmella** Braun

*Nepticula ulmella* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 87, 1912.

Palpi creamy white. Tuft ocherous on the face, tinged with red above, and sometimes with a few dark brown scales behind. Antennae creamy white, broadly banded above with dark brown, so that only a narrow line of the pale color appears between the annulations. Eye-caps creamy white. Thorax brownish, somewhat peppered. Scales of the fore wing creamy white, shading to dark brown at their tips, except where they form a creamy white oblique fascia at the middle of the wing. The general color of the fore wing is thus a somewhat mottled dark brown. The fascia, beginning at the middle of the wing on the costa, reaches the dorsum somewhat behind the middle, and is sometimes broken with a few dark-tipped scales. Cilia creamy white. Hind wings pale gray, with a pale bluish luster. Legs creamy white. Abdomen above gray, beneath pale straw-colored.

*Expanse.*—4 to 5 mm.

*Localities.*—Ohio; Kentucky; Pittsburgh, Pennsylvania (Engel).

The larvae are miners in leaves of red elm and cork elm (*Ulmus fulva* and *U. racemosa*). The mine (Fig. 45) starts as a very fine brown, or rarely whitish line, not very winding in its early course, and at about half its length abruptly enlarging to a breadth of 1 mm. From thence it continues to increase gradually in width, until it attains a breadth slightly in excess of two mm. The broad portion of the mine is usually so much contorted that it is not possible to trace the course of the mine, the whole having the appearance of an irregular blotch. The cocoon is reddish brown. Contrary to the usual habit among the American species that I have observed, a large proportion of the larvae spin cocoons within the mines, generally in the center of the blotch. This is

especially true of the generation which passes the winter in the cocoon.

There are two generations; mature larvae are found in July and in September.

The creamy white fascia and cilia, together with the pale bases of the scales, distinguish this species.

37. **Nepticula variella** Braun

*Nepticula variella* Braun, Ent. News, xxi, 173, 1910.

Tuft pale ocherous to ochraceous, with an occasional admixture of fuscous scales; collar and eye-caps creamy. Thorax dark fuscous. Ground color of fore wings sordid cream color, which in most specimens is almost overlain with fuscous, leaving only the apex of the wing and a more or less distinct fascia at the apical third of the ground color. Sometimes the dusting of the basal two-thirds of the wing is less dense, occasionally lacking toward the costal or dorsal margins, rarely reduced to a few scattered scales. Cilia fuscous, sometimes creamy around the apex. Hind wings gray, the basal half in the male overlain with purplish black scales. Abdomen and legs above fuscous, silvery beneath.

*Expanse.*—5.5 to 7.5 mm.

*Locality.*—Alameda County, California (Pilate).

The larvae form serpentine mines on leaves of California live oak (*Quercus agrifolia*), and on deciduous oaks. The length of the mine varies, being longer on the thinner-leaved deciduous oaks. Cocoon yellowish brown. Larvae mining leaves in January produce imagoes in late February and in March.

38. **Nepticula platanella** Clemens

*Nepticula platanella* Clemens, Proc. Ent. Soc. Phila., i, 83, 1861; ii, 133, 1862; Tin. No. Am., 173, 183, 192, 1872; Busck, Proc. Ent. Soc. Wash., v, 209, 1903; Dyar's No. 6209.

Syn. *maximella* Chambers, Can. Ent., v, 126, 1873; Dyar's No. 6202.

Tuft pale ocherous to ochraceous; eye-caps silvery white. Thorax and fore wings dark brown with a bluish luster. At the middle of the costal margin is a small oblique silvery streak, and opposite it on the dorsal margin is a similar streak, usually larger than the costal streak and broader on the margin. Rarely both spots are very minute. Occasionally these two streaks meet, forming a more or less interrupted concave fascia. Last row of scales around the apex pale yellowish at their bases, thus forming a dark line in the whitish cilia. Hind wings yellowish fuscous, in the male with a sword-shaped yellowish chitinous plate on the upper side from base to near middle of costa, margined along the costa with bristly black scales. Beyond this the costa is excised. Legs fuscous above. Abdomen fuscous above, with ocherous anal tuft.

*Expanse.*—5.5 to 7 mm.

*Localities.*—Pennsylvania (Clemens); Kentucky (Chambers); Washington, District of Columbia (Busck); Ohio.

The mines (Fig. 28) are abundant on leaves of sycamore (*Platanus occidentalis*) and begin as slender linear tracks usually filled with frass. Several days before pupation the mine is abruptly enlarged into a large usually almost circular blotch, which often covers the linear portion of the mine. Larva pale green; cocoon ochraceous.

There are three generations of larvae, the earliest to be found during June.

There is considerable variation in size of the white spots and it is but rarely that they form a fascia. Females may be distinguished from specimens of *N. clemensella* by the larger size, males from that and all other species except *N. similella*, by the peculiar chitinous plate along the costa of the hind wings.

39. **Nepticula clemensella** Chambers

*Nepticula clemensella* Chambers, Can. Ent., v, 125, 1873; Dyar's No. 6191.

Tuft ochraceous; eye-caps silvery white. Fore wings bluish black. A narrow oblique silvery streak on the middle of the costa (rarely inconspicuous) and an opposite dorsal streak, usually meeting in the male to form a narrow oblique fascia. Cilia silvery with a brown line formed by the dark tips of the terminal row of scales around the apex. Hind wings yellowish fuscous, similar in the sexes. Legs and abdomen fuscous above; anal tuft yellow in the male.

*Expanse.*—4.5 to 5.2 mm.

*Localities.*—Pennsylvania (Clemens); Kentucky (Chambers); Plummer's Island, Maryland (Busck); Ohio.

The larva mines leaves of sycamore (*Platanus occidentalis*), forming a linear mine gradually increasing in breadth, with its terminal portion expanded into a small blotch three or four times the diameter of the end of the linear mine (Fig. 29). Larva pale green; cocoon ochraceous. There are three generations a year.

This species is much less common than *N. platanella* and uniformly smaller, the largest specimens scarcely attaining the expanse of the smallest *N. platanella*.

40. **Nepticula similella** new species

Tuft ocherous to ochraceous; eye-caps silvery white, occasionally tinged with ocher. Thorax and fore wings deep bluish black, the extreme bases of the scales more or less iridescent blue, especially in the apical half of the wing. At the middle of the wing an oblique narrow costal streak, shining white but

not silvery, usually meets the apex of a shorter, broader dorsal streak. The tips only of the last row of scales around the apex are dark, thus forming a dark line in the white cilia. Hind wings gray; in the male with a narrow chitinous plate from base to one-third of costa, with a long yellowish costal hair-pencil lying along it. Legs and abdomen fuscous above, silvery beneath, with yellow anal tuft in the male.

*Expanse.*—5 to 6 mm.

*Localities.*—Cincinnati, Ohio; Powell County, Kentucky.

*Type material.*—Holotype (writer's collection); paratype (Acad. Nat. Sci. Phila.); eight paratypes (writer's collection).

Ten specimens, bred from larvae mining leaves of pin oak (*Quercus palustris*) in a single isolated locality east of Cincinnati; I have also observed a few mines on chestnut in Kentucky. The egg is placed on the upper side of the leaf. The early portion of the characteristic mine (Fig. 27) is very narrow, completely filled with frass, and bent several times in close S-shaped curves; the larva next mines just above the lower epidermis, forming a blotch scarcely visible above except for occasional spots here and there toward the edges of the blotch, where the leaf substance is more fully consumed; then a conspicuous large blotch is formed where the mine is transparent and whitish, with frass accumulated toward the beginning of the blotch. Larva pale green; cocoon ochraceous.

Females of this species can only be distinguished from those of *N. platanella* by the less shining costal and dorsal spots; males differ in the yellowish costal hair-pencil of the hind wings.

41. **Nepticula thoracealbella** Chambers

*Nepticula thoracealbella* Chambers, Can. Ent., v, 127, 1873; Dyar's No. 6222.
Syn. *badiocapitella* Chambers, Can. Ent., viii, 160, 1876; Dyar's No. 6186.

Tuft ochraceous on the face, becoming reddish brown on the vertex; eye-caps white. Thorax white, occasionally with a few scattered dark brown scales. Fore wings dark brown, slightly irrorated; a creamy white irregular fascia just before the middle concave toward the base and usually wider on the dorsal margin; at the apical fourth a distinct creamy white costal spot and an opposite dorsal spot, whose apices occasionally touch; cilia creamy white, sometimes grayish on the dorsum. Hind wings pale gray, cilia whitish. Legs creamy white, with outer surfaces of hind legs fuscous. Abdomen gray above, silvery beneath, with yellow anal tuft.

*Expanse.*—4 to 5 mm.

*Localities.*—Kentucky (Chambers); Ohio; Allegheny County, Pennsylvania (Marloff).

The published description of *N. badiocapitella* is practically identical with that of *N. thoracealbella;* this fact combined with the variability of specimens, leads to the conclusion that they apply to the same species. The life history is not known, but the species is evidently two brooded, as I have taken moths in May and July.

42. **Nepticula pomivorella** Packard

*Micropteryx pomivorella* Packard, Amer. Nat., vi, 685, 1872; *Nepticula pomivorella* (Packard), Busck, Can. Ent., xxxiii, 52, 1901; Dyar's No. 6211.

Tuft orange-ochraceous; eye-caps and collar shining pale buff. Thorax and fore wings shining bronzy, with strong purple and blue reflections increasing toward the apex. Cilia gray. Hind wings and cilia gray. Legs shining bronzy; hind tarsi yellowish. Abdomen dark brown, with purple reflections.

*Expanse.*—5 mm.

*Localities.*—Massachusetts (Packard, Fernald); Washington, District of Columbia (Busck); Ohio.

The larvae mine long narrow serpentine tracks (Fig. 10) on leaves of apple, gradually widening to 2 or 2.5 mm. at the end. Cocoon reddish brown.

This species is extremely common in some localities, but rare and seldom met with in others.

43. **Nepticula chalybeia** Braun

*Nepticula chalybeia* Braun, Can. Ent., xlvi, 20, 1914.

Palpi grayish ocherous. Tuft ocherous, sometimes shading to reddish brown above, collar yellowish white; antennae fuscous, eye-caps yellowish white. Thorax steel-gray. Fore wings very narrow, steel-gray, with faint greenish golden reflections. Cilia gray, faintly purple tinged around the apex. Hind wings gray. Legs gray, tarsi ocherous. Abdomen dark gray, with a purplish luster.

*Expanse.*—3.5 to 4 mm.

*Locality.*—Cincinnati, Ohio.

The larvae mine leaves of wild pear (*Pyrus communis*) and cultivated pear, making rather short serpentine tracks (Fig. 46), often not exceeding 2 cm. but sometimes reaching 3 cm. in length, and broadening to 1.5 to 2 mm. across at the end. The mined portion of the leaf very shortly turns dark brown. Larva bright green; cocoon dark brown. There are three generations a year; mined leaves may be collected in early June, in July and during the last part of August.

Its paler color, with absence of purple, narrow wings and smaller size separate this species from *Nepticula pomivorella*. It is apparently confined to pear as a food plant, as apple trees, adjacent to pear trees covered with the mines, are entirely free from them.

**44. Nepticula flavipedella** Braun

*Nepticula flavipedella* Braun, Can. Ent., xlvi, 19, 1914.

Palpi whitish. Tuft usually dark brown, collar creamy white; rarely the tuft is reddish ocherous on the face, brown on the vertex. Antennae fuscous, eye-caps creamy white. Thorax dark purplish brown. Fore wings dark brown, with dark blue and purple reflections; cilia with silvery tips. Hind wings and cilia gray. Fore legs, except the femora, dark brown; middle legs pale silvery, tarsi pale ocherous; hind legs silvery, tibiae dark brown, tarsi pale ocherous. Abdomen dark purplish above, paler beneath in the female.

*Expanse.*—3.5 to 4.5 mm.

*Localities.*—Ohio; Kentucky.

The mine (Fig. 48) is a very characteristic linear tract, occurring most commonly on pin and swamp white oak, but occasionally on other species of oak. The egg is placed on the upper side of the leaf and the larva for the first few millimeters mines near the upper surface, making a very narrow indistinct mine. Then the mine abruptly enlarges slightly and for a length of 8 or 9 mm., the leaf substance is entirely consumed and the mine rendered transparent. Then follows another enlargement, and the mine, often much contorted, increases very gradually in breadth to the end where it measures 2 mm. across. This latter portion of the mine is not transparent, but the mine is distinctly visible. The frass is sprinkled in separate grains across the breadth of the mine. The figure shows the appearance of the mine when held toward the light.

There are three generations a year; mines can be collected during early June, the latter half of July, and the early part of September. The larva is usually green, occasionally purplish, and escapes from the mine through the lower surface of the leaf. The cocoon is almost white.

Though very distinct in larval work, this species in the imaginal state is almost indistinguishable from *N. castaneaefoliella*. The yellowish middle and hind tarsi and the deeper purple suffusion of the fore wings are, however, constant differences.

45. **Nepticula castaneaefoliella** Chambers

*Nepticula castaneaefoliella* Chambers, Cin. Quart. Journ. Sci., ii, 117, 1875; Dyar's No. 6189.

Tuft black, collar, eye-caps and palpi creamy white. Thorax and fore wing dark brown, with slight bronzy and purple reflections; the tips of the scales are somewhat darker, so that under a lens, the wing is slightly irrorated especially toward the apex. Cilia silvery at the tips. Hind wings gray. Posterior tibiae and fore legs, except the femora, dark brown; legs otherwise whitish. Abdomen dark above, whitish beneath.

*Expanse.*—4 to 4.5 mm.

*Localities.*—Kentucky (Chambers); Ohio; Falls Church, Virginia (Heinrich).

The larvae form very long, much contorted, linear mines (Fig. 30) on leaves of chestnut (*Castanea dentata*), measuring but little over 1 mm. in width at the end, with a fine central line of frass. Larva bright green; cocoon ocherous. Chambers reports it also on white oak.

46. **Nepticula punctulata** Braun

*Nepticula punctulata* Braun, Ent. News, xxi, 174, 1910.

Tuft buff, usually becoming brownish on the vertex; collar buff; eye-caps pale buff. Fore wings pale grayish buff, each scale tipped with fuscous, giving the wing a finely peppered appearance. Cilia pale gray. Hind wings pale gray, tinged with buff. Legs and abdomen gray.

*Expanse.*—4.5 to 5.5 mm.

*Localities.*—California: Dutch Flat, Placer County; Loma Linda, San Bernardino County (Pilate); Yosemite Valley.

The larvae mine leaves of *Ceanothus cuneatus* and *Rhamnus californica*. The mine (Fig. 31) is a serpentine track, often bent back on itself and indistinct in its early stages on the thick-leaved *Ceanothus*, pale green with broad black line of frass on the *Rhamnus* leaves. Cocoon reddish brown or grayish.

The mines on *Ceanothus* from Dutch Flat were collected in January, those on *Rhamnus* from Yosemite in July.

The species is distinct in the evenly distributed dark dusting.

47. **Nepticula grandisella** Chambers

*Nepticula grandisella* Chambers, Journ. Cin. Soc. Nat. Hist., ii, 193, 1879; Dyar's No. 6198.

"Chiefly remarkable for its large size for this genus, having an *al. ex.* of over $\frac{3}{8}$ inch. Face, sordid, straw or sandy yellow, with palpi a little paler; eye-caps, white; antennae, reddish brown. Body, wings and legs brown. Texas."

I know this species only from the above description, and it may not be correctly placed in this genus.

48. **Nepticula belfrageella** Chambers

*Neptienla belfrageella* Chambers, Can. Ent., vii, 75, 1875; Dyar's No. 6187.

"Face pale yellowish; eye-caps white; antennae brown; thorax and primaries pale gray, darker toward the apex of the primaries, and with a fuscous spot at the apex. *Al. ex.* from $2\frac{1}{2}$ to over three lines. Season, April."

*Locality.*—Bosque County, Texas (Chambers).

49. **Nepticula latifasciella** Chambers

*Neptienla latifasciella* Chambers, Bull. Geol. Surv. Terr., iv, 106, 1878; Braun, Can. Ent., xlvi, 18, 1914; Dyar's No. 6200.

Tuft on the face ocherous, dark brown on the vertex; collar and eye-caps creamy. Thorax and extreme base of fore wings creamy-buff. Remainder of fore wing deep purple brown, with a very broad creamy-buff fascia just before the middle; two or three creamy-buff scales at the extreme apex forming with the creamy-white cilia around the apex a conspicuous pale spot. Cilia elsewhere gray. Hind wings and cilia gray. Legs creamy-buff, outer surfaces fuscous. Abdomen dark brown.

*Expanse.*—4 to 4.5 mm.

*Localities.*—Kentucky (Chambers); Falls Church, Virginia (Busck); Ohio; Allegheny County, Pennsylvania (Marloff).

The larvae mine leaves of red and scarlet oaks, and probably chestnut (Chambers). Although the mine varies in length from 3 to 5 cm. on different species of oak, with a breadth of about 1.5 mm. at its end, it has in general the same appearance (Fig. 47). The frass is at first deposited in a broad blackish line through the center, later dispersed across the entire breadth, and toward the end collected into a broad band. The larva is bright green and escapes from the mine through the lower epidermis of the leaf. Cocoon whitish or occasionally ochraceous.

This is one of the earliest species to appear in the spring; moths may be found resting on tree trunks during the latter part of April. Mines may be found in June, the latter part of July, in September, and often during late October.

50. **Nepticula crataegifoliella** Clemens

*Neptienla crataegifoliella* Clemens, Proc. Ent. Soc. Phila., i, 83, 1861; Tin. No. Am., 173, 1872; Braun, Can. Ent., xlvi, 17, 1914; Dyar's No. 6194.

Palpi pale ocherous. Tuft ocherous, faintly tinged with red above. Antennae ocherous, partly suffused with fuscous, eye-caps ocherous. Thorax and fore wings ocherous, the extreme edge of the costa near the base purplish

fuscous, and a broad purplish fuscous band at the apex of the wing. Beyond this band the cilia are pale ocherous, giving the appearance of an ocherous apex preceded by a dark band. Cilia opposite the ends of the band concolorous with it. Hind wings and cilia pale gray. Legs ocherous. Abdomen purplish fuscous above, ocherous beneath.

*Expanse.*—3.5 to 4.5 mm.

*Localities.*—Pennsylvania (Clemens, Marloff); Ohio; Kentucky.

Mines occur on several species of hawapple, most commonly on *Crataegus crus-galli* and *C. punctata;* Clemens notes it on C. *parvifolia* Ait. The mine (Fig. 49) is comparatively short, rapidly increasing in diameter and measuring about 2 mm. in width in the later portion of its course, with an irregular line of frass running through it. Larva bright green; cocoon reddish brown.

There are two generations a year; larvae may be collected in early July and at the beginning of September.

This species is distinguished from all others with yellowish ground color by the entire absence of dusting. The much broader mine and bright green larva separate it in early stages from *N. scintillans.*

51. **Nepticula nigriverticella** Chambers

*Nepticula nigriverticella* Chambers, Cin. Quart. Journ. Sci., ii, 118, 1875; Dyar's No. 6205.

Syn. *maculosella* Chambers, Journ. Cin. Soc. Nat. Hist., ii, 193, 1879; Dyar's No. 6201.

Face ochraceous, tuft above dark brown; collar and eye-caps pale ocherous, antennal stalk fuscous. Thorax and fore wings pale ocherous dusted with purplish black scales. At the base of the dorsal margin is a purplish black spot extending half way across the wing, and occasionally narrowly reaching the costa, which is often dark brown near the base. At the beginning of the cilia is a broad purplish black fascia; beyond it the cilia are pale ocherous. Hind wings and cilia pale grayish buff, sometimes darker. Legs pale ocherous.

*Expanse.*—5 mm.

*Localities.*—Kentucky (Chambers); Ohio; Texas (Chambers).

The range of variation of captured specimens taken in May at Cincinnati is sufficient to include N. *maculosella* described from Texas specimens.

52. **Nepticula populetorum** Frey and Boll

*Nepticula populetorum* Frey, and Boll, Stett. ent. Zeit., xxxix, 276, 1878; Dyar's No. 6212.

Tuft ocherous, becoming dark brown behind. Collar and eye-caps pale creamy, antennal stalk dark fuscous. Thorax and fore wings buff or pale

ocherous, more or less densely dusted with purplish fuscous scales. These scales form a purplish fuscous fascia at the beginning of the cilia. Cilia pale gray, whitish around the apex. Hind wings pale gray. Legs and underside of abdomen pale ocherous; abdomen above gray.

*Expanse.*—5 mm.

*Localities.*—Texas (Boll); Ohio; Kentucky; San Bernardino County, California (Pilate).

The larvae mine leaves of several species of poplar—in Ohio leaves of cottonwood (*Populus deltoides*). The mine (Fig. 8) is indiscriminately placed on the upper or the lower side of the leaf. It is a whitish, gradually broadening linear track, 2 or 2.5 mm. broad at its extremity, with a black line of frass. Cocoon ochraceous. In the latitude of Cincinnati there are several generations a year; mines containing larvae may be found in June, in the latter part of July, and in September.

This species differs from the preceding in the absence of the dark spot at the base of the dorsum.

53. **Nepticula saginella** Clemens

*Nepticula saginella* Clemens, Proc. Ent. Soc. Phila., i, 85, 1861; v, 146, 1865; Tin. No. Am., 175, 271, 1872; Busck, Proc. Ent. Soc. Wash., v, 220, 1903; Dyar's No. 6220.

Syn. *quercicastanella* Chambers, Can. Ent., v, 127, 1873; Dyar's No. 6215; *fuscocapitella* Chambers, Can. Ent., v, 128, 1873; Dyar's No. 6196.

Face ocherous or pale buff, head above dark brown; collar and eye-caps pale ocherous. Thorax and fore wings pale ocherous, buffish, or even whitish, and dusted with fuscous scales, often more densely toward the outer half of the wing, where the dark scales are either evenly distributed or collected into spots, but never form a band. Cilia pale ocherous. Hind wings pale gray. Legs and abdomen beneath pale ocherous; abdomen sometimes fuscous above.

*Expanse.*—4 to 5.5 mm.

*Localities.*—Pennsylvania (Clemens); Falls Church, Virginia (Heinrich); Kentucky (Chambers); Ohio; Texas (Chambers).

The mines occur on various species of oaks and on chestnut. The mine (Fig. 9) is a whitish linear tract varying in length and width, but usually about 1.5 to 2 mm. wide at its extremity, with a black line of frass running through it; the frass is occasionally more or less dispersed in parts of the mine. Tenanted mines may be found almost any time from June to October. Larva bright green; cocoon usually whitish, occasionally ochraceous.

54. **Nepticula pallida** Braun

*Nepticula pallida* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 85, 1912.

Palpi pale ocherous. Tuft ocherous, the scales on the vertex tipped with orange; antennae pale ocherous, eye-caps whitish. Thorax very pale buff. Fore wings very pale buff, evenly dusted with purplish gray, a little more densely toward the apex of the wing. Cilia very pale buff. Hind wings pale gray, tinged with ocherous. Legs and abdomen very pale buff.

*Expanse.*—4 mm.

*Locality.*—Cedar Point, Ohio.

The type specimen was bred from a mine on a narrow-leaved willow, *Salix* sp. The mine (Fig. 50) occurs on the lower side of of the leaf and is extremely narrow at first, extending along the midrib, later doubling on itself once or twice, and gradually and evenly increasing in breadth to its end, where it measures a scant 1.5 mm. across. The entire length of the mine is approximately 4.5 cm. The color is brownish throughout, and the mine is not at all transparent. The frass is distributed in a broad tract throughout the entire length of the mine. Cocoon reddish brown.

The pale head distinguishes this species from *N. saginella.*

*Species known only in the Larval State*

Several species named by Clemens from mine and larva still remain unbred and their identity cannot be determined. These are *Nepticula amelanchierella, N. anguinella,* and *N. platea.* These are later referred to under "Food Plants, Mines and Larvae." The empty mines to which Clemens applied the name *N.? prunifoliella* are doubtless the work of the species later described by Chambers as *N. serotinaeella,* which is regarded as a synonym of *N. bifasciella* Clemens.

In addition to these, many other species have been observed in the larval state, but not reared.

### 2. **ECTOEDEMIA** Busck

*Ectoedemia* Busck, Proc. Ent. Soc. Wash., viii, 97, 1907. Type: *E. populella* Busck.

*Generic characters.*—Basal segment of antennae enlarged and concave beneath to form an eye-cap. Labial palpi somewhat longer than in *Nepticula.* Middle spurs of posterior tibiae below the middle. Fore wings elongate ovate, pointed, jugum present in the female; hind wings $\frac{2}{3}$ to $\frac{3}{4}$, nearly as long as the fore wings.

*Venation* (Fig. 3).—Fore wings; media coalescing with cubitus at base, then passing obliquely to radius beyond $R_{2+3}$, and anastomosing with radius to beyond middle of wing. $R_4$ separate. Media single-branched. Cubitus reaching margin. Hind wings: media single-branched.

The position of the middle spurs on the posterior tibiae, the relatively smaller eye-caps, and broader wings will distinguish this genus from those species of *Nepticula* which have identical venation.

The larvae of the species whose life history is known form galls on twigs or petioles, or are miners in the bark of twigs. The egg is somewhat more circular in outline than that of *Nepticula*. There is but a single generation of the moths a year, as would be expected from the peculiarities of the life history.

In all but the unicolorous *E. populella*, the fore wings are mottled with fuscous scales, or with dark-tipped scales. Ill-defined markings are formed by the grouping of these dark scales in patches. The markings differ from those species of *Nepticula* which resemble *Ectoedemia* most in structural characters.

*Key to the Species of Ectoedemia*

a. Fore wings unicolorous.....1. **populella**
aa. Fore wings mottled.
b. Dark-tipped scales evenly distributed.....2. **castaneae**
bb. Dark-tipped scales more or less collected into patches.
c. Base of fore wing with scattered dusting except near costa.
5. **obrutella**
cc. Dusting dense near base of wing.
d. A poorly defined pale fascia at basal third.....4. **heinrichi**
dd. No fascia at basal third.....3. **phleophaga**

1. **Ectoedemia populella** Busck

*Ectoedemia populella* Busck, Proc. Ent. Soc. Wash., viii, 98, 1907.

"Antennae dark cupreous brown, basal joint forming a small eye-cap enlarged by heavy light yellow scaling. Face and head reddish ocherous. Thorax dark brown. Fore wings unicolored shining dark cupreous brown, with strong green and violet iridescence according to the light. Hind wings lighter cupreous brown, with ocherous cilia. Abdomen shining dark fuscous. Legs ocherous-fuscous with a bluish metallic sheen.

"Alar expanse: 7–8.5 mm."

*Localities.*—Massachusetts (Miss Clarke); New Hampshire (Koebele); Ohio.

The larvae form galls on petioles of leaves of poplar. "The gall is almost globular, of about the size of a pea, and is a swelling of the petiole close to the leaf; it is somewhat rugose longitudinally and of a grayish color. The course of the petiole is generally very distinct along its upper side, being smooth and of a reddish brown or yellowish color. The cavity is more or less irregular on account of the woody fibers, which run through the walls of the gall and which are not eaten by the larva." I have noted the galls on petioles of leaves of *Populus grandidentata* at Sugar Grove, Fairfield Co., Ohio. The larvae mature in October, the moths issuing in May of the following year.

2. **Ectoedemia castaneae** Busck

*Ectoedemia castaneae* Busck, Proc. Ent. Soc. Wash., xv, 103, 1913.

Palpi and lower part of face ocherous; tuft black above. Antennae fuscous with narrow pale annulations and creamy-white eye-caps. Thorax blackish brown, sprinkled with ocherous scales posteriorly, the tip ocherous. Scales of the fore wing bluish white, mostly deeply tipped with blackish brown, so that the wing appears almost uniformly densely dusted. Cilia fuscous. Hind wing dark fuscous, blackish along the costa, with lighter ocherous-fuscous cilia; male with a yellowish costal hair-tuft. Legs ocherous, shaded with fuscous outwardly. Abdomen dark fuscous with ocherous anal tuft and ocherous underside.

*Expanse.*—7.5 to 8 mm.

*Localities.*—Vietch, Virginia (Hopkins and Snyder); Powell County, Kentucky; Allegheny County, Pennsylvania (Marloff).

The larvae form galls encircling young twigs of chestnut, resembling in shape and size, as Mr. Busck notes, egg-masses of the forest tent caterpillar. Galls were observed on chestnut in Kentucky, but no moths were reared.

3. **Ectoedemia phleophaga** Busck

*Ectoedemia phleophaga* Busck, Ins. Insc. Men., ii, 3, 1914.

Palpi pale ocherous; tuft ocherous, sometimes dark tipped above. Antennae dark fuscous with narrow pale annulations and creamy-white eye-caps. Thorax and basal half of fore wings dark bluish fuscous; on the outer half of the wing the scales are paler, bluish toward their bases and tipped with black. A poorly defined light ocherous costal patch at the apical third and a similar patch opposite it on the dorsal margin. Hind wings and cilia pale ocherous fuscous; in the male with the costa excised from the middle and with a long pale ocherous hair-pencil at the base of costa. Legs ocherous on the inner side, fuscous outwardly. Abdomen yellowish fuscous.

*Expanse.*—9 to 10 mm.

*Locality.*—Falls Church, Virginia (Snyder, Heinrich, Busck).

"The larva * * * lives in the lower layer of the bark of chestnut just above and encroaching upon the cambium; the mine is a slender serpentine, a few millimeters broad and several inches long, often doubling upon itself and broadening out to twice or more in width in early spring, when the larva reaches maturity; in April and early May the full-grown larva leaves the bark and falls to the ground where it makes a closely woven, reddish brown cocoon amongst the rubbish, often boring down a few inches in the loose surface soil to find a suitable moist place on the underside of an old leaf or twig. The cocoon is oval, flattened, about 2 by 3 millimeters in diameter and 1.5 millimeters thick." The imagoes emerge during September of the same year.

This insect has been regarded as an important factor in the spread of the chestnut bark disease.

The species is distinguished from its allies by the almost uniform dark bluish fuscous color of the basal half of the fore wings, and the pale head.

4. **Ectoedemia heinrichi** Busck

*Ectoedemia heinrichi* Busck, Proc. Ent. Soc. Wash., xvi, 149, 1914.

Palpi pale ocherous, face and head black; antennae dark fuscous with narrow pale annulations; eye-caps creamy-white. Thorax pale ocherous, more or less dusted with blackish scales. Fore wings pale ocherous, densely dusted with blackish fuscous scales which tend to form patches, leaving usually the extreme base of the wing, except along the costa, and two poorly defined transverse fascia, one at the basal third, the other at the apical third, on which the dark dusting is absent or scattered. The second fascia is the less distinct and is sometimes almost obliterated by scattered dusting. Cilia pale ocherous, with a row of dark-tipped scales around the base. Hind wings and cilia fuscous; male with the costa excised from the middle and with a yellowish hair-pencil at base of costa. Legs ocherous. Abdomen yellowish fuscous above, pale ocherous beneath.

*Expanse.*—9 to 10 mm.

*Localities.*—Virginia (Heinrich); Ohio; Kentucky.

The larva forms a characteristic oval spiral mine in the bark of young branches of pin oak (*Quercus palustris*), well illustrated by Mr. Busck in a photograph accompanying the original description. The mine is a narrow linear track, closely coiled in a flattened oval spiral, resembling a watch spring; the empty egg shell often remains attached to the bark in the center of the

mine after the larva has deserted the mine. The bark of old mines cracks and often breaks away entirely, leaving the inner bark exposed, producing scars which persist for a number of years. The larvae are found chiefly on young saplings, but are also found on outer branches of trees, wherever the growth is unusually long and vigorous.

The larvae are full grown in October and early November, producing moths in May and June of the following year.

5. **Ectoedemia obrutella** Zeller

*Trifurcula obrutella* Zeller, Verh. zool.-bot. Ges. Wien, xxiii, 316, 1873.

*Ectoedemia obrutella* (Zeller), Busck, Proc. Ent. Soc. Wash., xv, 103, 1913; xvi, 149, 1914; Dyar's No. 6226.

Syn. *bosqueella* Chambers, Bull. Geol. Surv. Terr., iv, 106, 1878; Busck, Proc. Ent. Soc. Wash., v, 208, 1903; Dyar's No. 6229.

Head pale ocherous, sometimes black (Chambers); antennae fuscous, eye-caps white. Fore wings pale ocherous, slightly iridescent, and dusted, more densely in the male than in the female, with coarse brown scales, which are most numerous toward the apex. For a short distance from the base, the costa is black, more conspicuously so in the male. Toward the base of the inner margin the dusting is least dense. Cilia pale yellowish gray, with marginal row of dark scales. Underside of fore wings darker than the hind wings which are pale grayish, with paler more yellowish cilia. Legs pale ocherous. Abdomen gray, with yellowish anal tuft.

*Locality.*—Texas (Boll, Chambers).

### 3. **OBRUSSA** Braun

*Obrussa* Braun, Can. Ent., xlvii, 196, 1915. Type: *O. ochrefasciella* Chambers.

*Generic characters.*—Eye-cap large. Labial palpi well developed. Middle spurs of the posterior tibiae above the middle. Fore wings elongate ovate, with jugum in the female; hind wings a little over one-half.

*Venation* (Fig. 4).—Fore wings; media coalescing with cubitus at base, then passing obliquely to radius beyond $R_{2+3}$, and anastomosing with radius to beyond middle of wing. $R_4$ separate. $M_1$ and $M_2$ coalescing for a short distance beyond separation of M and R. $M_3$ absent. Cubitus becoming obsolete beyond its separation from M. Hind wings; media single-branched.

Represented by a single species whose early stages are entirely unknown. In the male the row of spines along the costal edge of the hind wing is preserved unmodified, except that the individual spines are weaker and not curved.

1. **Obrussa ochrefasciella** Chambers

*Nepticula ochrefasciella* Chambers, Can. Ent., v, 128, 1873.

*Obrussa ochrefasciella* (Chambers), Braun, Can. Ent., xlvii, 196, 1915; Dyar's No. 6207.

Palpi pale ocherous; tuft ochraceous; antennae fuscous, with narrow pale annulations; eye-caps pale buff. Thorax and fore wings blackish brown, almost black in the basal third. A broad pale ocherous fascia at the basal third; at two-thirds are some scattered paler scales, sometimes (in female) forming an indistinct line across the wing. Cilia around the apex and last row of scales at the extreme apex pale ocherous. The underside of the wing in the male from base to outer edge of fascia on the costa, and nearly to tornus on dorsum, is clothed with close set ocherous androconia; this area in the female though paler is not definitely outlined. Hind wings gray, ocherous toward the base in the male; cilia gray. Legs dull ocherous, shaded with fuscous outwardly. Abdomen fuscous, with yellow anal tuft in the male.

*Expanse.*—6.5 to 8 mm.

*Localities.*—Kentucky (Chambers); Ohio; Allegheny County, Pennsylvania (Marloff); New Hampshire (Busck).

### 4. **GLAUCOLEPIS** new genus

*Generic characters.*—Eye-cap large. Middle spurs of posterior tibiae in the middle. Fore wings elongate ovate; hind wings nearly equaling the fore wings in breadth in the male, three-fourths in the female.

*Venation* (Fig. 6).—Fore wings: cubitus coincident with media, which anastomoses with radius from $R_{2+3}$ to beyond middle of wing. $M_3$ absent; $M_2$ arising before separation of M and R. Hind wings: media two-branched.

Type: *Glaucolepis saccharella* Braun (*Nepticula saccharella* Braun).

Apart from the general structural characters, which easily distinguish this genus from its allies, the great breadth of the hind wing of the male, nearly equaling that of the fore wing, is a striking character.

The larva of the only known species is a miner in leaves, forming extremely long linear mines. The cocoon is similar to that of the other genera, considerably flattened, with projecting rim extending entirely around it.

1. **Glaucolepis saccharella** Braun

*Nepticula saccharella* Braun, Journ. Cin. Soc. Nat. Hist., xxi, 97, 1912.

Tuft brownish ocherous, more or less intermixed with dark brown, sometimes entirely dark brown. Antennae brownish ocherous, broadly ringed with

black; eye-caps silvery white, with a bluish luster, sometimes becoming blackish outwardly. Thorax and basal fourth of the fore wing shining with a bright blue or purple metallic luster. Ground color of the remainder of the wing black. There is a rather broad shining silvery fascia just beyond the middle of the wing, broadening and curving toward the base as it approaches the dorsum. When viewed at some angles, this fascia shows pale blue reflections. Cilia shining pale bluish, with a line of dark scales through their middle. Hind wings and cilia gray, with a bluish luster in the female; in the male with the costal margin beset with black scales, and a bunch of black hair-scales near the middle of the dorsal margin; an oval pale yellowish patch of androconia. Legs metallic iridescent. Abdomen dark brown above with a faint bluish luster, much paler beneath and bluish.

*Expanse.*—4 mm.

*Locality.*—Ohio.

The larvae form long serpentine mines (Fig. 51), 13 or 14 cm. in length, in leaves of sugar maple (*Acer saccharum*) and occasionally red maple (*Acer rubrum*), in which the loosened epidermis is pale green and a black line of frass extends through the middle of the mine. The numerals in the figure mark the length of the mine on the respective dates indicated. Larva pale green; cocoon ocherous, regularly oval, much flattened and smooth, with projecting rim extending entirely around it.

Mined leaves may be collected in early July and late August; sometimes the larvae of a third generation are found in October. Moths from the overwintering pupae emerge in May and June.

## Food Plants, Mines and Larvae

The characteristic and constant form of the mine, and the fact that each species of *Nepticula* and its allies is confined to one plant or at most to a few closely related plants, permits of ready identification in the early stages. Because of this fact, the list of food plants and descriptions of mines occurring on them has been compiled in the hope that it will be an aid to the collector in identifying his specimens.

*Salix* spp., Willow:

(1) *N. pallida;* mine linear, narrow at the end (Fig. 50).

(2) *N. fuscotibiella;* mine linear, gradually broadening, club shaped at the end, sometimes blotch-like toward the end (Figs. 25, 44).

*Populus grandidentata,* Poplar:

(1) *E. populella;* globular swelling of petiole close to leaf.

*Populus deltoides,* Cottonwood:

(1) *N. populetorum;* whitish mine gradually increasing to a breadth of 2 to 2.5 mm. at end (Fig. 8).

*Myrica cerifera*, Wax Myrtle:
(1) *N. myricafoliella;* mine serpentine, very narrow (Fig. 22).
*Myrica carolinensis*, Bayberry:
(1) *N. obscurella;* mine serpentine, very narrow (Fig. 19).
*Juglans cinerea*, Butternut:
*Juglans nigra*, Walnut:
(1) *N. juglandifoliella;* serpentine mine very gradually increasing in breadth (Fig. 39).
*Carya* spp., Hickory:
(1) *N. juglandifoliella;* serpentine mine very gradually increasing in breadth.
(2) *N. trinotata;* linear track expanding into a blotch (Fig. 33).
*Corylus americana*, Hazel:
(1) *N. corylifoliella;* very narrow serpentine mine scarcely broader than the larva.
(2) *N. quadrinotata;* narrow linear mine, expanding into an irregular blotch.
*Ostrya virginiana*, Hop Hornbeam:
(1) *N. corylifoliella;* very narrow serpentine mine scarcely broader than the larva (Fig. 40).
(2) *N. ostryaefoliella;* linear track gradually reaching a breadth of 2 mm., at the end.
*Carpinus caroliniana*, Hornbeam:
(1) *N. corylifoliella;* very narrow serpentine mine scarcely broader than the larva.
(2) *N. quadrinotata;* narrow linear mine, expanding into an irregular blotch (Fig. 13).
*Betula* spp., Birch:
(1) *N. corylifoliella;* very narrow serpentine mine scarcely broader than the larva.
(2) *N. ostryaefoliella;* linear track gradually reaching a breadth of 2 mm., at the end (Fig. 20a, b).
*Alnus tenuifolia*, Narrow-leaved Alder:
(1) *N. canadensis;* short serpentine mine abruptly enlarging into a blotch (Fig. 26).
*Castanea dentata*, Chestnut:
(1) *N. castaneaefoliella;* long contorted mine with central line of frass (Fig. 30); larva green.
(2) *N. saginella;* shorter whitish mine with frass in a central line or dispersed; larva green.
(3) *N. latifasciella;* serpentine mine; frass at first in a broad line later dispersed and toward end gathered into a band; larva green.
(4) *N. similella;* see under *Quercus* (8).
(5) *E. castaneae;* larva makes a gall encircling twig.
(6) *E. phleophaga;* larva makes a serpentine track in the bark.

*Quercus* spp., oaks:

(1) *N. terminella;* mine a broadening linear tract, 3.5 mm. wide at the end; larva yellow (Fig. 36).

(2) *N. saginella;* whitish linear mine with frass in a central line or dispersed (Fig. 9); larva green.

(3) *N. latifasciella;* serpentine mine; frass at first in a broad line, later dispersed and toward the end gathered into a band (Fig. 47); larva green.

(4) *N. flavipedella;* linear mine; a short indistinct portion followed by a transparent area, then a gradually broadening serpentine track, not transparent, but easily visible above (Fig. 48); larva green.

(5) *N. anguinella* Clemens, Proc. Ent. Soc. Phila., i, 85, 1861; Tin. No. Am., 175, 1872. "May be found in the leaves of oaks early in October and in the latter part of June. The mine is a very narrow serpentine tract, *which is filled or discolored throughout its length by blackish excrement.* The larva fits the mine closely, in color lemon-yellow, with ten square dark brown or blackish spots on the ventral surface."

It should be possible to recognize this species, when found, from Clemens' description of the larva.

(6) *N. platea* Clemens, Proc. Ent. Soc. Phila., i, 85, 1861; Tin. No. Am., 175, 1872. "Mines oaks early in October. The mine is a moderately broad, winding tract, with a broad line of dispersed grains of excrement. The larva is purplish, with a pale green vascular line and a row of reddish-brown dorsal dashes. The mine is much broader than that of the preceding miner."

The statement that the larva is purple can not be regarded as conclusive, since such color is often produced in larvae feeding on leaves with autumnal coloration.

*Quercus alba,* White Oak:

(7) *N. quercipulchella;* long, narrow, winding and gradually widening track; larva bright green.

*Quercus palustris,* Pin Oak:

(8) *N. similella;* linear mine expanding into an underside blotch, followed by a large conspicuous nearly transparent blotch (Fig. 27); larva pale green.

(9) *N. altella;* lower side, very long serpentine mine, not distinctly visible (Fig. 37); larva yellow with row of dark brown dashes.

(10) *E. heinrichi;* flattened oval spiral mine in bark of young branches.

*Quercus agrifolia,* California Live Oak:

(11) *N. variella;* serpentine mine.

*Ulmus* spp., elms:

(1) *N. apicialbella;* narrow serpentine mine (Fig. 43).

(2) *N. ulmella;* narrow linear track enlarging into an irregular blotch (Fig. 45).

*Platanus occidentalis*, Sycamore:

(1) *N. platanella;* narrow linear mine, abruptly enlarging into a large blotch (Fig. 28).

(2) *N. clemensella;* linear mine, gradually broadening with terminal portion expanded into a small blotch (Fig. 29).

*Physocarpus opulifolius*, Opulaster:

(1) *N. opulifoliella;* brownish contorted serpentine mine (Fig. 38).

*Pyrus communis*, Pear:

(1) *N. chalybeia;* serpentine mine (Fig. 46).

*Pyrus malus*, Apple:

(1) *N. pomivorella;* serpentine mine, usually broadening to 2 or 2.5 mm. (Fig. 10).

*Amelanehier canadensis*, Service Berry:

(1) *N. amelanehierella* Clemens, Proc. Ent. Soc. Phila., i, 84, 1861; Tin. No. Am., 174, 1872. "In the leaves of service-berry or Juneberry, *Amelanehier canadensis*, in June and July. The mine rather a broad tract, sometimes much contorted, with rather irregular edges, placed most often toward the base of the leaf and having a rather broad 'frass' line of a dark brown color."

This species seems to be distributed wherever its food plant occurs, as I have observed untenanted mines on the leaves in central Ohio, in Kentucky, and in North Carolina.

*Crataegus* spp., Hawapple:

(1) *N. crataegifoliella;* serpentine mine with a breadth of about 2 mm., at the end (Fig. 49).

(2) *N. scintillans;* contorted serpentine mine, scarcely exceeding 1 mm. in breadth (Fig. 11).

*Rubus* spp., Blackberry, Raspberry:

(1) *N. villosella;* narrow serpentine mine (Fig. 18).

(2) *N. rubifoliella;* short narrow linear mine, expanding into a blotch (Fig. 23).

*Rosa* spp., Rose:

(1) *N. rosaefoliella;* serpentine mine (Fig. 42).

*Prunus serotina*, Wild Black Cherry:

(1) *N. bifasciella;* narrow serpentine mine (Fig. 15).

*Prunus americana*, Wild Plum:

(1) *N. bifasciella;* narrow serpentine mine.

(2) *N. slingerlandella;* narrow linear mine, abruptly enlarging into an irregular blotch (also on cultivated plums and prunes, and sweet cherry).

*Ptelea trifoliata*, Hop Tree:

(1) *N. pteliaecella;* very long, much contorted, narrow serpentine mine (Fig. 12).

*Rhus toxicodendron*, Poison Ivy:

(1) *N. rhoifoliella;* narrow contorted serpentine mine (Fig. 34).

*Rhus* spp., Sumac:

(1) *N. intermedia;* narrow contorted serpentine mine (Fig. 16).

*Acer saccharum*, Sugar Maple:
*Acer rubrum*, Red Maple:
(1) *Glaucolepis saccharella;* very long linear mine (Fig. 51).
*Condalea ferrea*, Black Ironwood:
(1) *N. condaliafoliella;* contorted serpentine mine.
*Rhamnus lanceolata*, Buckthorn:
(1) *N. rhamnicola;* linear mine expanding into an irregular blotch (Fig. 35).
*Rhamnus californica*:
(1) *N. punctulata;* serpentine mine.
*Ceanothus divaricatus*:
(1) *N. ceanothi;* contorted mine, scarcely exceeding 1 mm. in breadth (Fig. 14).
*Ceanothus cuneatus*:
(1) *N. punctulata;* short, narrow indistinct mine (Fig. 31).
*Tilia americana*, Basswood:
(1) *N. tiliella;* serpentine mine (Fig. 41).
(2) *N. argentifasciella;* indistinct linear mine, expanding into a blotch (Fig. 32).
*Nyssa sylvatica*, Sour Gum or Pepperidge:
(1) *N. nyssaefoliella;* linear mine abruptly expanding into a blotch (Fig. 24).
*Oxycoccus macrocarpus*, Cranberry:
(1) *N. paludicola;* serpentine track, in part following the margin of the leaf (Fig. 21).

## *List of Genera and Species*

1. **Nepticula** von Heyden
   1. argentifasciella Braun
   2. scintillans Braun
   3. pteliaecella Chambers
   4. quadrinotata Braun
   5. trinotata Braun
   6. ceanothi Braun
   7. bifasciella Clemens
      *serotinaecella* Chambers
   8. intermedia Braun
   9. diffasciae Braun
   10. rhamnicola Braun
      *rhamnella* Braun
   11. cerea Braun
   12. rhoifoliella Braun
   13. terminella Braun
   14. villosella Clemens
      *dallasiana* Frey and Boll
   15. resplendensella Chambers
   16. unifasciella Chambers
   17. purpuratella Braun
   18. obscurella Braun
   19. ostryaefoliella Clemens
   20. paludicola Braun
   21. myricafoliella Busck
   22. altella Braun
   23. corylifoliella Clemens
      *virginiella* Clemens
      *minimella* Chambers
   24. opulifoliella Braun
   25. quercipulcbella Chambers
   26. condaliafoliella Busck
   27. juglandifoliella Clemens
      *caryaefoliella* Clemens
   28. apicialbella Chambers
      *leucostigma* Braun
   29. tiliella Braun
   30. rubifoliella Clemens

31. nyssaefoliella Chambers
32. slingerlandella Kearfott
33. rosaefoliella Clemens
34. fuscotibiella Clemens
*ciliaefuscella* Chambers
*discolorella* Braun
35. canadensis Braun
36. ulmella Braun
37. variella Braun
38. platanella Clemens
*maximella* Chambers
39. elemensella Chambers
40. similella Braun
41. thoraecalbella Chambers
*badiocapitella* Chambers
42. pomivorella Packard
43. chalybeia Braun
44. flavipedella Braun
45. castaneaefoliella Chambers
46. punctulata Braun
47. grandisella Chambers
48. belfrageella Chambers
49. latifasciella Chambers
50. erataegifoliella Clemens
51. nigriverticella Chambers
*maculosella* Chambers
52. populetorum Frey and Boll
53. saginella Clemens
*quercicastanella* Chambers
*fuscocapitella* Chambers
54. pallida Braun
55. amelanchierella Clemens
(Larva)
56. anguinella Clemens (Larva)
57. platea Clemens (Larva)

2. **Ectoedemia** Busck
1. populella Busck
2. eastaneae Busck
3. phleophaga Busck
4. heinrichi Busck
5. obrutella Zeller
*bosqueella* Chambers

3. **Obrussa** Braun
1. ochrefasciella Chambers

4. **Glaucolepis** Braun
1. saecharella Braun

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Through the courtesy of the United States National Museum, material in this family was sent to me for study. I have also examined a number of species from Mr. Fred Marloff's collection.

## EXPLANATION OF PLATES

### Plate V

Fig. 1.—Wings of *Nepticula nyssaefoliella*, female.
Fig. 2.—Wings of *Nepticula nyssaefoliella*, male.
Fig. 3.—Wings of *Ectoedemia heinrichi*, female.
Fig. 4.—Wings of *Obrussa ochrefasciella*, male.
Fig. 5.—Wings of *Nepticula terminella*, female.
Fig. 6.—Wings of *Glaucolepis saccharella*, male.
Fig. 7.—Cross-section of mine of *Nepticula saginella*.
Fig. 8.—Mine of *Nepticula populetorum* (No. 52).
Fig. 9.—Mine of *Nepticula saginella* (No. 53).
Fig. 10.—Mine of *Nepticula pomivorella* (No. 42).

### Plate VI

Fig. 11.—Mine of *Nepticula scintillans* (No. 2).
Fig. 12.—Mine of *Nepticula pteliaeella* (No. 3).
Fig. 13.—Mine of *Nepticula quadrinotata* (No. 4).
Fig. 14.—Mine of *Nepticula ceanothi* (No. 6).
Fig. 15.—Mine of *Nepticula bifasciella* (No. 7).
Fig. 16.—Mine of *Nepticula intermedia* (No. 8).
Fig. 17.—Mine of *Nepticula diffasciae* (No. 9).
Fig. 18.—Mine of *Nepticula villosella* (No. 14).
Fig. 19.—Mine of *Nepticula obscurella* (No. 18).
Figs. 20a, 20b.—Mines of *Nepticula ostryaefoliella* (No. 19).
Fig. 21.—Mine of *Nepticula paludicola* (No. 20).
Fig. 22.—Mine of *Nepticula myricafoliella* (No. 21).
Fig. 23.—Mine of *Nepticula rubifoliella* (No. 30).
Fig. 24.—Mine of *Nepticula nyssaefoliella* (No. 31).
Fig. 25.—Mine of *Nepticula fuscotibiella* (No. 34).
Fig. 26.—Mine of *Nepticula canadensis* (No. 35).
Fig. 27.—Mine of *Nepticula similella* (No. 40).
Fig. 28.—Mine of *Nepticula platanella* (No. 38).
Fig. 29.—Mine of *Nepticula clemensella* (No. 39).
Fig. 30.—Mine of *Nepticula castaneaefoliella* (No. 45).
Fig. 31.—Mine of *Nepticula punctulata* (No. 46).

### Plate VII

Fig. 32.—Mine of *Nepticula argentifasciella* (No. 1).
Fig. 33.—Mine of *Nepticula trinotata* (No. 5).
Fig. 34.—Mine of *Nepticula rhoifoliella* (No. 12).
Fig. 35.—Mine of *Nepticula rhamnicola* (No. 10).
Fig. 36.—Mine of *Nepticula terminella* (No. 13).
Fig. 37.—Mine of *Nepticula altella* (No. 22).
Fig. 38.—Mine of *Nepticula opulifoliella* (No. 24).
Fig. 39.—Mine of *Nepticula juglandifoliella* (No. 27).
Fig. 40.—Mine of *Nepticula corylifoliella* (No. 23).

Fig. 41.—Mine of *Nepticula tiliella* (No. 29).
Fig. 42.—Mine of *Nepticula rosacfoliella* (No. 33).
Fig. 43.—Mine of *Nepticula apicialbella* (No. 28).

## Plate VIII

Fig. 44.—Mine of *Nepticula fuscotibiella* (No. 34).
Fig. 45.—Mine of *Nepticula ulmella* (No. 36).
Fig. 46.—Mine of *Nepticula chalybeia* (No. 43).
Fig. 47.—Mine of *Nepticula latifasciella* (No. 49).
Fig. 48.—Mine of *Nepticula flavipedella* (No. 44).
Fig. 49.—Mine of *Nepticula crataegifoliella* (No. 50).
Fig. 50.—Mine of *Nepticula pallida* (No. 54).
Fig. 51.—Mine of *Glaucolepis saccharella*.

# THE GENUS NEONEURA (ODONATA)

BY E. B. WILLIAMSON

The present paper is the outcome of an effort to identify material collected in Guatemala, British Guiana and Trinidad by B. J. Rainey, L. A. Williamson and myself. When Dr. Calvert learned I was studying this material he kindly offered me material and notes collected by himself in Costa Rica, informing me that his material included one probably new species. This species proved to be the same as one we had collected in Trinidad, and it is described and named in this paper. Through the good offices of Dr. Ris, I obtained drawings from M. Menger of species in the de Selys collection. Unfortunately since de Selys' work was done, the *Neoneura* specimens in his collection have been greatly damaged, and only a limited number could be figured. I have also, through the kindness of Dr. Calvert, Mr. Kahl, Dr. Henshaw and Professor Needham, been able to study the *Neoneurae* in the several collections in their charge, so that I know at first hand all the species but *waltheri* and *rufithorax*, neither of which, most unfortunately, Menger could figure. The figures of appendages and thoracic patterns which accompany this paper, except where otherwise indicated, have been made by Mr. Kennedy, whose aid is gratefully acknowledged. The wing photographs were kindly made for me by Mr. Munz.

De Selys' separation of *Neoneura* into two groups on the basis of abdominal coloration served some purpose in identifying material, but gives no hint of relationships, since some of the closest allies are thereby separated. Real relationships are indicated, I believe, by the male appendages, and, to a lesser extent, by female thoracic color patterns and prothoracic hind lobes, but the females of several species are not known at this time. My ideas of relationships are indicated in the key to males and the sequence of species in the text.

The most valuable specific characters are found in the male appendages and the prothoracic hind lobes of the females. In the latter case it must be noticed that in those species in which lateral developments of this border occur, these developments are

usually relatively weakly chitinized and some variation or post-mortem distortion must be looked for. The superior appendages of the male are involved, the inferiors simple. A real comprehension of the form of the superior can come only after prolonged study in many views with a binocular microscope. Throughout the genus the parts may be homologized in all the species. The external face of the superior is divided more or less distinctly into two parts, the lower part usually the smaller and simpler, consisting generally of a more or less horizontal plate, the outer angle of which (alone seen in profile view) is commonly better developed than the inner angle, which is ordinarily acute, black-tipped and resting against the inferior appendage. The upper branch of the superior consists of a more or less expanded plate, with a generally interno-dorso-posteriorly directed surface. The dorsal edge of this plate varies in different species from a practically smooth, continuous condition to a more or less indentate or armed condition, with prominent or large, but usually blunt, posteriorly directed tubercles. The dorsal view of the appendage shows the various forms of this edge; for example, *joana* has it developed near the base in a broad blunt triangle; in *aaroni* there is near its mid-length a small distinct beak-shaped prominence. The dorso-posterior angle of the upper part of the superior appendage is also more or less variable in the different species; usually it is a rather uniformly rounded and inconspicuous end, as in *aaroni* for example, but in *joana* it is produced posteriorly in a long triangular projection overhanging the inferior appendage. But the greatest modifications of the superior appendage are concerned with the inner surface of the upper part, below the dorsal edge discussed above. This surface is often irregularly triangular in form, the apex occupying more or less of the cleft dividing the appendage into the superior and inferior parts, as may be seen in the profile view of *sylvatica* (figure 37) for example. A number of modifications of this part occur, the most peculiar of which possibly is in *fulvicollis*, where the surface cannot be detected in dorsal or lateral views, but where a posterior view shows it as a long, narrow, ventrally directed, thorn-like body (figure 70, which compare with figure 39). In *myrthea* also this part is strikingly different from the more usual, roughly triangular form, being long and finger-shaped (see figure

47) but occupying a normal position, not shifted basally and into a ventrally directed position as in *fulvicollis*.

Nothing is known of the larva of any species.

### *Key to the Males of Neoneura*[1]

a[1]. First postnodal descending cross-vein forked at its posterior end to enclose a marginal four-sided cell; abdominal appendages slightly longer than tenth, thick at base, gradually constricted beyond the middle and curved toward each other in a blunt end, terminated by a black point; abdomen, 34 mm., hind wing, 22 mm..... **waltheri**[2]

a[2]. Not as above.

b[1]. Pale markings throughout bright sky blue; thorax with black adjoining mid-dorsal carina more than one-third the width of the mesepisternum; third to seventh segments with dorsum widely blue, not reduced to a line, sides black..... **joana**

b[2]. Not as above.

c[1]. Pale markings bright yellow, or yellowish or greenish; black on either side of mid-dorsal carina more than one-third the width of the mesepisternum; eighth segment entirely yellow, except about the apex. **bilinearis**

c[2]. Pale colors not yellow.

d[1]. Head, thorax and basal abdominal segments above bright blue or bluish, apex of third and fourth to tenth red or reddish; thoracic dark markings reduced..... **sylvatica**

d[2]. Not as above.

e[1]. Thorax with black area adjoining mid-dorsal carina at least more than one-third the width of the mesepisternum; abdomen red with black reduced or wanting.

f[1]. Thoracic dorsal black or dark brown more or less broken into transverse lines or bars, especially noticeable along the outer edge.

g[1]. *N. denticulata*, a single teneral male known; see figure 10, and discussion of species in text.

g[2]. Black markings, if any, on mesepimeron disconnected spots; pale colors of thorax red or reddish..... **rubriventris**

[1]This key must be used with caution because of the already known great ontogenetic variation in colors of certain species, and the likelihood that other variations than those known at this time exist. Variations other than those due to age may also be discovered when larger material is available. All determinations made with the key should be checked by reference to both text and figures. Unless otherwise specified, the characters in the key refer to fully colored mature specimens. Absence of material renders a discussion of tenerals impossible.

[2]Translated from de Selys; not known to me; only a single male from Brazil known.

g³. Mesepimeron with a distinct black stripe, pale colors of thorax blue or slaty..... **ethela**

f². Not as above.

g¹. Pale colors of thorax blue or slaty; abdomen about 26 mm..... **ethela**

g². Pale colors of thorax red or reddish.

h¹. Abdomen about 30 mm..... **mariana**

h². Abdomen about 24 mm..... **myrthea**

e². Thorax with black area adjoining mid-dorsal carina wanting, reduced to a series of spots, or not one-third the width of the mesepisternum.

f¹. Dorsum of thorax with irregular, transverse brown lines or bars, other thoracic markings reduced to irregular spots; abdomen almost entirely red..... **rubriventris**

f². Thorax not as above.

g¹. Thorax with a series of spots or a narrow stripe or bar along the mid-dorsal carina.

h¹. Abdomen predominantly pale.

i¹. Abdomen clear blue with some yellowish and reduced black..... **rufithorax**[3]

i². Not as above.

j¹. Abdomen largely red, dorsum of eighth and ninth segments largely pale..... **esthera**

j². Abdomen dull, pale; dorsum of eighth and ninth segments black..... **aaroni** (juv.)

h². Abdomen predominantly black.

i¹. Abdominal segment two pale above, bordered and patterned with black.

j¹. Dorsum of head with a fairly straight, transverse bar of black through the lateral ocelli from eye to eye; metepimeron pale.

k¹. Colors red and black; abdominal segment nine largely dark above..... **carnatica**

k². Colors blue and black; segment nine largely blue above..... **maria**

j². Dorsum of head with a conspicuous, more or less quadrangular, black area posterior to and including the lateral ocelli, and continuous with the extreme posterior black margin of the head as seen in dorsal view (sometimes this quadrangular black area with pale spots in it); metepimeron with traces of dark to entirely black..... **amelia**

i². Segment two entirely dark above..... **aaroni** (adult)

g². Mid-dorsal thoracic dark markings (except sometimes near the ante-alar sinus) and mesepimeral median dark stripe wanting.

[3]Known to me only from de Selys' description.

h¹. Abdomen with black predominating, eighth segment entirely dark above..... **paya**
h². Abdomen with pale predominating, eighth segment with basal two-thirds pale above..... **fulvicollis**

*Key to the Females of Ten Species of Neoneura*

a¹. Thorax with much dark color, dorsum largely dark.
b¹. Abdomen, 22 mm.; posterior border of prothorax with lateral lobes greatly developed, more produced than middle lobe..... **myrthea**
b². Abdomen, 28 mm.; posterior border of the prothorax straighter with the lateral lobes not conspicuous..... **mariana**
a². Thorax pale, dorsum irregularly marked with darker transverse bars. **rubriventris**
a³. Thorax largely light brown, dorsum with dark on either side of mid-dorsal carina reduced to a narrow irregular line or a series of spots.
b¹. A transverse black bar or line across the head through the lateral ocelli; a broad black line on the mesepimeron. **maria** and **carnatica**; see text on **maria**
b². Head otherwise; mesepimeron with black markings reduced and adjacent to the sutures.
c¹. Hind border of prothorax trilobed, the lateral lobes each with an added prominence or tooth.
d¹. Knees black, posterior face of outer surface of femora black; black on dorsum and sides of abdominal segment nine divided..**joana**
d². Legs pale, posterior face of outer surface of femora scarcely dusky; black or brown on dorsum and sides of segment nine continuous. **bilinearis**
c². Hind border of prothorax trilobed, the lateral lobes simple.
d¹. Lateral lobes low, scarcely evident..... **aaroni**
d². Lateral lobes conspicuous but not as high as middle lobe; abdominal segment nine largely dark above..... **amelia**
d³. Lateral lobes conspicuous, about as high as middle lobe; segment nine light yellow or brown above..... **esthera**
a⁴. Thorax light brown, dorsum without spots or stripes? **paya** and **fulvicollis** (both unknown)

**Neoneura joana** new species (Figs. 1, 2, 31, 32, 75, 76 and 99.)

Abdomen, ♂ 23 to 26 mm., average 24.2; ♀ 22 to 23: hind wing, ♂ 15 to 16.5, average 15.4; ♀ 15.5 to 17.

♂.—Genae bright pale blue. Labrum, rhinarium, nasus and frons in front bright blue; labrum with a median basal black spot; nasus with a spot on either side, reaching the base, and the base narrowly between these spots, black. Frons above and vertex bright blue, intricately patterned with black; the median ocellus is surrounded with black, posteriorly a branch from this runs back between the lateral ocelli surrounding them, except on their outer anterior sides, and continuing posteriorly onto the occipital crest, widest just behind the lateral ocelli; anterior from the median ocellus is a wide branch which at

once forms a trident, none of the branches of which reach the front edge of the frons; from either side of the median ocellus a black bar runs directly to and surrounds the antenna, from which it is produced forward and inward in one branch to the front edge of the frons, and, in a second branch, produced backward and outward against the eye, which is very widely bordered with black from this point backward; from each lateral ocellus a black bar runs outward and forward to meet the black area along the eye; this black bar may be joined to the black around the ocellus or widely separated from it; in the former case the blue area behind the bar and on either side of the median black of the occipital crest is two-branched at its outer end, one branch running forward and outward, the other backward and outward, toward the eye from which they are widely separated; in the latter case, *i.e.* when the black bar above described is separated from the lateral ocellus, the pale area behind it is joined across the gap with the spur-like pale area running outward and forward from the lateral ocellus toward the antenna, from which it is widely separated; opposite the occipital crest, and slightly posterior to it, is a very small pale spot near the eye, reduced to the merest point in one specimen; and posterior to this small spot is a short transverse pale bar, just discernible from above, which is still more widely separated from the eye. Antenna with second joint black, apex blue, remainder brown, third joint pale at base. Rear of head black, bordered with pale greenish blue against the eyes.

Prothorax black; sides and anterior border of front lobe blue, wider on the sides; middle lobe with a bright blue spot on either side occupying most of the lobe; posterior edge of hind lobe blue bordered. Propleuron with the upper half black and lower half bright blue in irregular pattern.

Thoracic colors bright blue and black, the blue only slightly paler on the sides and below.

Abdomen bright light blue and black, seen from above largely blue; basal two-thirds of segment one black; two with a wide longitudinal black bar on either side not reaching base or apex, subapically produced dorsally in a triangular spur which almost meets with the one on the opposite side; segments two to six with very narrow, scarcely discernible, basal black rings, and two to ten with apical black rings or apical black more extensive; three to seven have the longitudinal lateral black stripe like two, separated from the base as in two, but reaching the apex; the blue dorsum and the subapical blue area, defined by the dorsal development of this stripe, become progressively narrower from three to seven; the basal third or slightly more of eight is entirely blue, narrowing from this point back to near the apex of the segment, with a subapical constriction; nine dorsally black, a large quadrate sub-basal blue spot on either side; ten, black. Sides below bright blue or, on three to six, yellowish; the lateral black stripe on three to six widening near the apex and reaching the lower margin; black spot on eight of irregular pattern, longest below, but not reaching the base or the lower margin, enclosing a large subapical blue spot near its lower posterior portion, this blue spot often continuous along its lower part with the blue of the entire extreme lower border of the segment; nine with the large sub-basal blue spot described in dorsal view, and a subapical blue spot homologous

with the subapical blue spot on eight, but the sides below of nine are black to the extreme border; the large quadrate spot and the subapical blue spot may be narrowly joined at the lower posterior angle of the quadrate spot; ten entirely black, with a small blue spot near the middle—the homologue of the subapical blue spot on the preceding segments. Ventral suture black. Appendages black. Legs pale dull yellow; femora dark externally, especially on the posterior face and apically, where the inner side is black; tibiae dark on the inner side and, in the front legs, on the anterior external face; tooth on tarsal claw about as in *myrthea*.

Wings clear, in only one specimen slightly tinged; stigma brown to almost black, covering one cell or very slightly less, its costal length from slightly less than to slightly more than twice its width.

♀.—Genae cream or pale gray. Labrum yellow or light brown, paler below, a median basal black spot. Rhinarium, nasus and frons in front light brown; nasus patterned as in the male. Frons above and vertex brown, variably patterned with black; in the paler specimen the black area about the ocelli (see description of male) is reduced to a small spot just behind the median ocellus, and a spot just inside and posterior to each lateral ocellus; of the trident in front of the median ocellus only the three apices remain; the lateral bar on either side of the median ocellus is entirely gone, though the second joint of the antenna remains black; the bar outward and forward from the lateral ocellus begins about one-third the distance from the ocellus to the eye, from which point it runs directly to the eye, the entire region in front of it and immediately posterior to it, pale; a black spot on either end of the occipital crest; and outside and posterior to this is a black transverse bar as in the male, the adjoining region of the eyes narrowly black margined. In the darker specimen all the above spots and bars are present and larger, and in addition there is a dusky spot on either side of the median ocellus, and a large round spot near, but not touching, the eyes midway between the black bar from the lateral ocellus and the posterior transverse bar. Antenna with second joint black, white at apex; basal half of third joint white or pale; remainder black or dark brown. Rear of head black, pale above and the eyes broadly margined with pale.

Prothorax brown; front lobe with a posterior black spot on either side; middle lobe with a median longitudinal black line and a dusky indefinite spot above on either side; hind lobe with a large round black spot on either side, lateral margins pale. Propleuron brown, upper half paler, bordered above and in front with dusky or black.

Thoracic colors light brown and black.

Abdomen above dull blue, pale and disappearing on segment seven, and apparently wanting on eight to ten; one with basal half black; two to eight with extremely narrow basal rings, sometimes evident only as a small median spot; two to six with distinct, and seven to nine indistinct apical black rings; two to seven with a subapical black area on either side, joined in the middorsal line on two and three, narrowly separated on four to six and a little more widely on seven, the subapical pale area enclosed between this dark area and the apical ring is the same color as the color anterior

to it on the same segment, except on six and still more on seven where it is duller, becoming yellowish; eight above dull yellowish brown with subapical spots, homologous to those on the preceding segments, broadly joined on either side with a lateral stripe; nine greenish yellow, on either side a large triangular basal black spot two-thirds to three-fourths the length of the segment, dorsum of apex black; ten largely black, a small median spot and apex pale. Seen from the side in one female the dorsal blue is bordered with a black line, beginning subbasally and ending in the subapical black area, this black line scarcely evident on segment two, most distinct on three to eight; in the other female this dark border is present but less developed, scarcely evident on two and three, more or less interrupted on four and five, and on three to six narrowly separated from the blue dorsum by pale yellow; sides below pale, more or less irregularly varied with light bright yellow, dull yellow, and greenish reflections; sides of eight dull yellow, a submedian dark spot near the lower border; nine dull yellow, a basal dark spot or stripe two-thirds its length, near the lower border; lower edge of genital valves and valvular processes distinctly black; ten pale.

Legs light yellow or cream; posterior external face of the femora, their apices and the inner face of the tibiae, dusky or black.

Wings hyaline; stigma light brown, covering one cell or slightly less.

British Guiana: all in 1912; near the mouth of the Potaro River, February 4; Tumatumari, February 4, 7, 9 and 11; Rockstone, February 14: a total of ten males, two females.

*Type*.—♂, February 11; ♀, allotype, February 7; Tumatumari, in writer's collection. Named for Mrs. Jane Atkinson, wife of Dr. D. A. Atkinson, a companion on numerous collecting trips to whom I am indebted for many specimens.

This bright blue and black species is as different from other *Neoneura* I have seen in life in its habits as in its colors. As we ascended the Essequibo River from Rockstone they were seen several times flying over the river far from the shores, and the first one taken came near enough to be netted when our boat was entering the Potaro River. The river at this time was in very low water stage, and on a long sand bank at the water's edge below Tumatumari the species was frequently seen. The female, attended by the male, oviposits in leaves partly embedded in damp sand, though often at some distance from the water, but where a rise of the river, if only a few inches, would submerge them. The species is as active as its congeners, and its bright blue color, with the sharply patterned black, gives it a brilliance scarcely less than some of its flaming relatives.

**Neoneura bilinearis** Selys (Figs. 3, 4, 5, 33, 34, 35, 36, 77, 78 and 100.)

Abdomen, ♂ 24 to 26 mm., average 25; ♀ 23: hind wing, ♂ 15 to 16, average 15.7; ♀ 16 to 17.

♂.—Genae yellow. Labrum, rhinarium, nasus and frons in front greenish yellow; labrum with a median basal black spot; nasus with a black spot on either side in front and a dusky longitudinal median stripe, the latter often wanting. Frons above and vertex with an intricate and variable pattern of greenish yellow and black. The palest pattern is as follows: each ocellus is surrounded by black, but separated by included pale lines; from the body of black about the median ocellus three bars of black arise, one anteriorly in the median line and one on either side; the median bar branches into a trident, the middle prong of which alone reaches the angle of the frons; the lateral bars from the ocellus, one on either side, run outward and forward to the angle of the frons, then backward and outward to the antenna and posterior to it where each branches, one short branch ending against the eye, the second branch, longer and narrower, ending opposite and near the lateral ocellus; directly posterior to this termination of the longer branch is a black spot at the end of the occipital crest; just posterior to the shorter branch, which ends against the eye, is a large round black spot which touches the eye and is produced posteriorly as a narrow black border against the eye; posterior to this large round black spot is a short wide transverse bar of black at the posterior border of the vertex; the occipital crest is black at the center. In the maximum black pattern the following changes have taken place: the lateral branches of the trident fuses each on its outer side with the lateral black bar from the median ocellus, leaving a small squarish pale spot included; the black areas about the ocelli, the occipital crest and against the eyes fuse with the resulting pattern in pale; a very small spot between and another on either side in front of the lateral ocelli; from each lateral ocellus a pale bar runs toward the antenna, reaching about two-thirds the distance; this pale bar at its posterior end dilated into a spot from which three branches arise, a short one running around and behind the ocellus, another running forward and outward toward the eye and the third running backward and outward toward the eye; opposite each termination of these two last branches is a pale spot nearly against the eye; the black thus bounded by these two branches and the two spots is the large round black spot against the eye, described above in the pale color pattern. Antenna with second joint black, pale at apex; third joint brown, paler basally; remainder brown. Rear of head with a yellow transverse bar above, not reaching the eye; below this a broad yellow border against the eye; remainder black.

Prothorax with front lobe black, anterior border and a large median spot, yellow; middle lobe yellow with a wide median longitudinal black band which is greatly widened at the anterior border; hind lobe black, posterior edge narrowly yellow except in the median line. Propleuron black, yellow or dusky at the extreme lower edge.

Thorax yellow and black, the yellow paler on the sides and below; only slightly variable as shown by specimens before me (see figures 3 and 4).

Abdomen black above; a wide apical yellow spot on segment one; a wide yellowish-green median longitudinal stripe on two, widening basally but not quite reaching the base of the segment, subapically constricted or divided, forming a subapical round spot; three similar, but the narrow basal black ring of segment two represented by a small median basal spot only; four similar, the dorsal stripe narrower except at the base, and the subapical portion reduced to a median line; five similar, with the median stripe still more reduced, the subapical part a vestige only; six similar, the expanded base of the pale longitudinal median stripe persisting, but otherwise scarcely discernible except at its subapical end; seven similar to six, the base yellowish-green and with a subapical median narrow yellow spot; eight conspicuously yellow with an irregular subapical spot on either side and a narrow apical ring, black, the two subapical spots sometimes joined to form an apical quadrangular spot, continuous with the apical transverse ring; nine black, a subapical yellow spot on either side below; ten black. Seen from the side, segments one and two with the lower half yellow, one with its lower posterior border more or less dusky; three to six with the lower border broadly pale or greenish yellow, progressively narrower posteriorly, especially at the apex of the segments; seven below more broadly dark yellow; eight entirely yellow, except for the apical black described in dorsal view; nine black, except for yellow spots described in dorsal view, and a ventral prolongation of these which reaches the lower border; ten black. Ventral suture black, except on eight to ten where it is dull yellow. Superior appendages black, paler basally; inferiors yellow, slightly darker apically.

Legs bright clear yellow, the posterior external face of the femora and the anterior external face of the tibiae slightly dusky, most marked on the first legs and least on the third; apices of femora, spines and the tips of the tarsal claws, black; tooth on tarsal claw about as in *esthera*.

Wings clear or slightly tinged; stigma yellowish brown or brown, covering very slightly less than one cell, its costal length equal to or slightly greater than twice its width. Of wings examined, in one case the descending cross-vein from the subnodus does not reach the wing margin, but stops at $Cu_1$. All terminations of $Cu_1$, A, and the descending cross-vein from the first postnodal are normal.

♀.—Genae gray. Labrum, rhinarium and nasus light yellowish brown; labrum paler below, a median basal dark or black spot; nasus with a black spot on either side and a median longitudinal dusky bar. Frons in front pearl gray, yellowish tinged. Frons above and vertex olivaceous pearl gray; two dusky spots in front of the median ocellus represent the apices of the lateral branches of the black trident of the male; below (anterior to) the antenna is a dark spot against the eye; about half way between the lateral ocellus and the eye a narrow dusky or black line starts, and runs outward and forward against the eye, which has a narrow dusky or black border posterior to this point; a dusky spot at each end of the occipital crest; outside and slightly posterior to this a short transverse dusky bar equally separated from the spot on the occipital crest and the eye. Antenna with second joint gray on its outer face, dark or black on the inner, nearly white at the apex; remainder brown, the

third joint pale basally. Rear of head light pale yellow, immediate region of the occipital foramen largely black.

Prothorax brown; front lobe with the anterior border paler, a black spot on either side posteriorly; middle lobe with a very narrow longitudinal median black line; hind lobe with an anterior black spot on either side. Propleuron brown, a dusky or black spot above on the anterior border.

Thoracic colors are light brown above and below, and on the sides light yellow to almost white, the markings black and dark brown.

Abdomen above brown; segment one paler and yellow apically; segments two to six with subapical transverse dark or black rings, which are narrowed or divided in the median line, and with the apex narrowly black ringed; the lower border of the dorsal brown more or less distinctly darker bordered; three to six narrowly pale at base; on two to six the area between the subapical dark rings or areas and the apical black rings is yellow or greenish yellow, paler on the basal segments; seven dull yellow, the dark borders of the preceding brown dorsa persisting on either side as an interrupted longitudinal black or dusky stripe, the subapical black ring represented by a subapical black spot on either side; eight dull yellowish brown, the subapical black area represented by a spot on either side about mid-length of the segment; nine with basal two-thirds black, a longitudinal median bar and the apex dull yellowish brown; ten dull yellowish brown with a little ill-defined black at base. Sides below yellowish green, growing darker posteriorly and changing to dull yellowish brown. Ventral suture black, dull on segments eight to ten.

Legs light pale yellow, unmarked; spines and tips of tarsal claws black.

Wings clear; stigma light brown, covering one cell or slightly less. In one right hind wing A is a floating vein, the apical sixth wanting. In other cases $Cu_1$, A and the descending cross-veins are normal.

Brazil: Espiritu Santo, one male, Coll. Carnegie Museum;[4] Poco Grand, Dec. 28, 1897, one male, Cornell Coll.

British Guiana: Wismar, January 29, 30 and 31, 1912, sixteen males, two females.

I already have described briefly the small stream between Wismar and Christianburg[5] where we collected, among other things, the beautiful *Diastatops dimidiata*, the shadowy *Epipleoneura lamina* and *fuscaenea*, and the peculiar *Cyanogomphus conchinus*. It was here also, and here alone, that we found *Neoneura bilinearis*. Just above the foot bridge over the creek was a fair sized pool with a few logs strewn about and, on the right bank, some vegetation which reached out over the water, a typical *Neoneura* habitat. *Bilinearis* is a slender, peculiarly

[4]Calvert, Ann. Carneg. Mus., vi, p. 212.

[5]Notes on Neotropical Dragonflies: Proc. U. S. Nat. Mus., 48, p. 626, (May 12, 1915).

colored *Neoneura*, but in flight and alertness it is similar to its congeners. The detailed description has been prepared because the only other published description, that of de Selys, seems to be based on badly discolored material.

**Neoneura sylvatica** Selys (Figs. 6, 37, 38, 39 and 79.)

I have seen the three males in the Carnegie Museum.[6] Before I had seen these specimens I could scarcely believe de Selys' description was accurate, and I thought the original material was probably faded or discolored and therefore misleading. Such is not the case, and this is certainly an odd and beautiful species, with its blue thorax and basal abdominal segments with the remainder of the abdomen bright red. The break in the two colors is abrupt, taking place at the interrupted narrow subapical dark ring on the third segment.

**Neoneura ethela** new species (Figs. 7, 42, 43 and 80.)

Abdomen, ♂ 26.5 mm.; hind wing, ♂ 18.5.

♂.—Genae light blue or green. Labrum and rhinarium olive, the former paler and yellowish along lower border, a median posterior black spot and the sides extensively black except below. Nasus black, a small yellowish spot on either side near the posterior border. Frons in front blue or green. Head above olive or bluish, intricately patterned with black as follows: median ocellus surrounded with black with two short posterior bars inside the lateral ocelli and extending slightly beyond them, where the bars are transversely joined in the median line; from the median ocellus, on either side a bar runs outward, then forward and outward over the inner face of the second joint of the antenna; in front of the ocellus are three broad bars, one median, reaching the anterior edge of the frons, and one on each side running outward and forward to the anterior lateral edge of the frons, then backward and outward to the inner face of the second joint of the antenna; from the lateral ocellus, and narrowly separated from the black behind it, a bar runs outward and forward to end against the eye; posterior to this and also touching the eye is a large round spot; posterior to this round spot is a transverse bar of black, not quite reaching the eye, and ending at the extremity of the occipital crest. Antenna brown, excepting inner face of second joint which is black. Rear of head yellow above, remainder black with the lower part adjoining the mouth parts and a narrow margin at the eyes, pale, yellowish above, greenish or bluish below.

Front lobe of prothorax black, anterior border and a posterior spot on either side, yellowish; middle lobe olive, a wide median longitudinal line, and an oblique bar the full length on either side, the two converging anteriorly; hind lobe black, very narrowly pale margined posteriorly. Propleuron olive or yellowish, black margined above and in front.

Thoracic pale colors blue or slaty, paler below.

[6]Calvert, Ann. Carneg. Mus., vi, p. 212.

Abdomen red; segment one with a large squarish basal dorsal black spot and an oblique stripe on the sides below; sides of two yellowish, dark brown at base, this produced backward nearly or quite the length of the segment in two bars, one slightly above the lower edge, the other at about two-thirds the height of the segment; a similar single dark bar just above the narrow pale yellow lower border on three; more or less definite traces of the same on four and five; sides of eight and nine largely, and the apex of ten, dark brown, shading out above; a more or less distinct subapical dark spot on either side of the dorsum on eight and nine; median apex of ten black, shading out anteriorly, reaching nearly the base. Ventral suture black. Superior appendages black above, remainder reddish brown, lower edge darker; inferiors dull reddish yellow.

Legs pale brownish yellow, outer surface of femora dark, black on the first two pairs, shading out basally, encircling the femur apically, the angle between the anterior and posterior faces narrowly yellow; anterior outer face and inner face of tibiae of first two pairs largely black; tooth on tarsal claws well developed, larger than in *sylvatica* or *mariana*.

Wings clear; stigma brown, covering very slightly less than one cell, its length about two and one-half times its width.

*Type*.—Brazil: Rio Grande do Sul, (H. V. Ihering), ♂, Coll. Acad. Nat. Sci. Phila. This and one other male is the material listed by Calvert as *N. rubriventris*.[7] Only one of the specimens, designated as the type, has been seen by me. Dr. Calvert writes that the two are identical. Named for my sister, Ethel, wife of J. E. Merriman.

*Ethela, sylvatica, mariana* and *denticulata* are four closely related species. In *ethela* the appendages are scarcely separated from *sylvatica*, the differences minute and possibly disappearing in a large series. The outer branch or angle of the lower part or division of the superior appendage, in interno-posterior view, in *ethela* is a symmetrical triangle; in *sylvatica* the upper edge is concave, the lower edge convex and the branch itself is narrower. The same view of the inner face of the upper part of the superior shows slight and scarcely definable differences in the two species, and there are many identical, even minute, details, such as, for example, a slight trough-like vertical depression across the surface just posterior to the lower beak-like termination of the surface, this beak-like termination resting just above and inner to the inner angle of the lower branch of the superiors, and identical in the two species. However, in this view of the appendages the upper and lower edges of the inner face of the upper part of

[7]Ann. Carneg. Mus., vi, p. 212, (1909).

the superior appendage are more convex in *sylvatica*, and form a less regular triangle than is the case in *ethela*. From the closely related *mariana* and *denticulata*, *ethela* is more distinct, the appendages furnishing specific characters. In *mariana* and *denticulata* the upper branch of the superiors is longer; in *mariana* the lower branch is rounded, the apex semicircular, not triangular as in *ethela*.

In thoracic color pattern *ethela* is strikingly like *mariana* and entirely different from *sylvatica*, but in view of the limited material available these differences must not be given too much weight; while the pattern is similar in *mariana* and *ethela* I believe that certainly the pale color of *ethela* is blue or bluish as in *sylvatica*. Material of *sylvatica* and *ethela* seen by me seems equally mature, and the strikingly blue basal abdominal color of *sylvatica* is entirely wanting in *ethela*. As the red on the abdomens of specimens is about equally intense, it is probable that the difference in the basal segments is specific and not ontogenetic. See text under discussion of *maria*.

**Neoneura mariana** new species (Figs. 8, 9, 40, 41, 81, 82 and 101.)

Abdomen, ♂ 28.5 to 31 mm., average 29.7; ♀28: hind wing, ♂ 19 to 20.5, average 20; ♀ 21.

♂.—Genae light reddish brown. Labrum and rhinarium reddish brown, labrum with a median basal dark or black spot. Nasus black. Frons in front dark shining reddish brown, darker above. Frons above and vertex colored almost exactly as in *myrthea* with only the following exceptions: in *myrthea* area between the eye and antenna is black, in *mariana* reddish brown; the reddish brown spot between the lateral ocellus and antenna is usually in *mariana* divided into two contiguous spots; and the occipital crest is reddish brown or black. In one specimen the spots are unusually large and there is an additional spot at either end of and anterior to the occipital crest, but not as far anterior as the lateral ocellus. Antenna black or very dark brown. Rear of head black, a narrow border of brown against the eyes.

Prothorax black; front border narrowly reddish yellow; middle lobe with two longitudinal reddish yellow spots on either side; posterior lobe with extreme external edge pale or black. Propleuron largely black, lower posterior border and an irregular central area reddish yellow.

Thoracic dark colors above black, with a scarcely discernible trace of red, the lateral dark markings showing but a slight trace more; dorsal pale markings dark reddish yellow, growing paler and more yellowish below.

Abdomen red; segment one basally above and on the sides, but not reaching the lower edge, black, pale color yellowish red above to yellow below, a lateral apical black spot; segment two with sides yellowish red, a

longitudinal dark area above the accessory genitalia; two to nine with narrow apical black rings, most distinct on two to six and least on eight to nine; ten narrowly black basally above. Seen from the side three has a basal black spot at the extreme inferior margin; sides of three to six bright red, shading out only slightly towards the lower border; seven to ten darker, more obscure (possibly postmortem changes), with definite black markings confined to nine and ten; nine with a longitudinal black band on basal two-thirds of the segment, separated from the lower border by an almost equally wide pale area; above this black band is a more or less distinct dark or black area of slightly greater extent; ten basally with reduced homologous areas. Ventral suture black. Superior appendages black; inferiors reddish brown varying to black.

Legs brown; femora black externally and more or less internally at apex; tibiae black lined on the anterior external face; tarsi and tip of tarsal claws, black; tooth on tarsal claw small, about as in *myrthea*.

Wings slightly tinged with brown to more deeply tinged with yellowish brown; stigma dark reddish brown, covering slightly less than one cell, its costal length equalling two to two and one-half times its width. Wing venation the most variable of any species. (See tabulation.)

♀.—Genae light brown. Labrum and rhinarium as in the male. Nasus narrowly black at base, on either side this black produced forward and inward in a broad bar reaching the anterior edge of the nasus; median area brown, dusky at the center. Frons in front light brown. Frons above and vertex light reddish brown, intricately patterned with black, probably variable, here described as in the single female taken; in front of each ocellus is a small pale area; a large body of black lies between the lateral ocelli and posterior to them, but leaving the occipital crest narrowly pale; from this body of black, back of each lateral ocellus a broad black bar runs forward and outward to meet the eye posterior to the level of the antenna; in front of the median ocellus is a five-pronged body of black, on either side a bar at the level of the median ocellus runs outward and backward to meet the bar from the lateral ocellus to the eye, on either side a bar runs outward and forward to the edge of the frons, then turns outward and backward and ends on the second joint of the antenna, and the fifth bar is median and runs directly forward nearly to the edge of the frons; at either end of the occipital crest a pale area extends outward and forward to the eye, this is dilated at either end and is homologous to the two similarly located spots in the male; posterior to this, near the extreme edge of the head, is another pale spot against the eye, extreme posterior border with a short transverse pale bar, not reaching the eye, almost concealed in dorsal view. While the head has been described above as pale marked with black, this is for convenience only, as the total black areas greatly predominate the total pale areas. Antenna with second joint pale externally and apically, black on inner face; remainder brown. Rear of head black, a yellowish border, wider than in the male, next to the eyes.

Prothorax with front lobe black, bordered anteriorly with dull yellow; middle lobe dull light brown with the median line and a large indefinite rounded spot on either side black; posterior lobe black, the outer edges and the posterior

edge medianally, broadly bordered with yellowish brown. Propleuron as in the male, with pale colors duller and brown replacing black.

Dark thoracic colors on dorsum black with a greenish cast; on the sides, black with a reddish cast; pale areas brown, paler on the sides and below.

Abdominal segment one similar to that of the male but with the pale colors brown; dorsum of segments two to ten brown, two with a narrow basal ring represented on three to eight by a small median basal black spot, and on nine and ten by a large spot which covers about two-thirds of each segment; two to eight with narrow apical black rings; two to six with a subapical oblique black ring, between which and the apical black is a pale dull yellowish area, rings and pale area most distinct on two and three, on four to six interrupted in the mid-dorsal line with the pale area growing progressively posteriorly darker, practically disappearing on six, where the subapical ring is reduced to a dusky spot on either side. Sides below with a longitudinal black stripe just above the extreme lower edge which is yellow, this yellow widest and most distinct on the anterior segments disappearing on seven, but well developed and reddish brown in color on eight; the black bar wide on nine, occupying most of the side except the extreme apex; represented on ten by obscure basal and apical shadings. Ventral suture black.

Legs brown, with less black than in the male; the external black of the femora reduced throughout, especially basally and on the third femora where it disappears in a series of round spots; the black on the tibiae also reduced, but here especially apically where on the third tibiae it disappears in a series of round spots; tarsi as in the male.

Wings clear; stigma light brown, covering slightly less than one cell.

British Guiana: all in 1912; Wismar, January 31; Tumatumari, February 9; Potaro Landing, February 10: a total of six males, one female.

*Type.*—♂; Tumatumari, February 9: allotype ♀; Potaro Landing, February 10; in the writer's collection.

This species is named for Miss Mary M. Shafer, and its close relative, *myrthea*, is named for her sister, Miss Myrth Shafer, in grateful recognition of their long services as bibliographers and assistants in the "bug room."

This species, in de Selys' grouping, belongs with *rubriventris*, *sylvatica* and *rufithorax*, from all of which it is separated at once, among other characters, by the dark color of head and thorax. In the characters of both sexes it is extremely close to *myrthea;* the males of the two species may be separated at once by the long, rod-like development of the lower inner face of the upper part of the superior abdominal appendage in *myrthea*.

This large and brilliant *Neoneura* is a veritable gem in life as it flies over the pools of small shaded tropical streams and rests

in the overhanging vegetation. In my dried material the abdomen has remained a brilliant red.

**Neoneura denticulata** new species (Figs. 10, 44, 45 and 83.)

Abdomen, ♂ 25 mm.: hind wing, ♂ 17.

♂.—Colors teneral and obscure; genae, labrum, rhinarium, nasus and frons in front pale brown, labrum more yellowish, nasus with extensive obscure darker brown markings. Head above dull yellowish brown, marked with black as follows: a stemless trident in front of the median ocellus; a short bar forward and inward from the antenna to the front edge of the frons; a small spot behind the median ocellus and on each side on the inner side of each lateral ocellus; a short bar or spot between the median ocellus and the antenna; a transverse bar behind the lateral ocelli just in front of the occipital crest, which is produced outward and forward on either side in a broken bar or stripe to the eye; a round spot at either end of the occipital crest, more or less connected with a black transverse bar on either side, on the extreme posterior edge of the head in dorsal view, which does not reach the eye; in the large pale area, on either side anterior to this transverse bar, is a large, centrally located rounded spot. Antenna brown, second joint darker, distal extremity pale. Rear of head pale brown, black or darker about the foramen.

Prothorax pale yellowish brown with extensive obscure darker markings; front lobe with the extreme front border pale, an obscure transverse bar just posterior to this, and a posterior spot on either side; middle lobe with the longitudinal median line darker, and a large indefinite obscure area on either side the full length of the lobe, but not reaching the lateral margin; hind lobe with the posterior edge and the lateral extremities pale, remainder brown, enclosing on either side in front a transverse pale spot. Propleuron brown, darker margined above and in front.

Thorax brown, mesepisternum yellowish, tending to red, markings brown and black, obscure.

Abdomen yellow, sparsely marked, segment one with the usual dorsal basal black spot; two to six apically narrowly dark ringed; eight to ten with some evidence of dark markings.

Legs light yellowish brown, femora and tibiae with scarcely defined scattered brown spots; tooth on tarsal claw, weak, not quite as inconspicuous as in *maria*, but much smaller than in *mariana*.

Wings clear; stigma pale brown, covering slightly less than one cell, its costal length slightly more than twice its width. In the right hind wing the marginal cell posterior to the subquadrangle is divided by a transverse crossvein near its mid-length.

*Type*.—Teneral ♂; Iquitos, Peru; Staudinger; Coll. Museum of Comparative Zoology. The specimen is in poor condition and only the distinct abdominal appendages justify its description and designation as a type.

Undoubtedly the color of the adult will prove to be similar to *mariana*, the head and thorax largely dark, and the abdomen

largely bright red. In the form of the appendages it is most like *mariana*, and yet definitely distinct. The most striking difference is in the lower branch of the superior appendage seen on the interno-posterior face. In *mariana* this is an almost symmetrical smooth round tubercle[8], well marked off at its base from the upper branch of the superior; in *denticulata* the lower branch is a continuation, after an acute angle, of the lower edge of the upper part, and it is not at all a tubercle, but is a small roughly triangular plane, with the exposed sides thickened and rounded, the posterior edge (just beneath the upper part of the superior) armed near its middle with two juxtaposed black teeth. The upper branch or part of the superior is slenderer in *denticulata* than in *mariana*, and there is a small median tooth on the upper edge in the latter which is wanting in *denticulata*. The lower, internal expanded plate of the upper part of the superior is alike in both species, acute triangular in shape and moderately developed. In profile view the meeting of the upper and lower branches of the superior appendages is much more abrupt and angular in *denticulata* than in *mariana*. The specific name refers to the two minute teeth on the lower branch of the superior appendage. The gizzard has been described by Miss Higgins.[9]

**Neoneura myrthea** new species (Figs. 11,12, 46, 47, 84, 85 and 102.)

Abdomen, ♂ 23 to 24.5 mm., average 23.8; ♀ 22: hind wing, ♂ 16 to 17, average 16.4; ♀ 18.

♂.—Genae dark reddish brown. Labrum black, lower border, for a varying width, dark reddish brown. Rhinarium dark reddish brown or black. Nasus black. Frons in front reddish black. Frons above and vertex black, a minute scarcely discernible reddish brown spot between the lateral ocellus and the antenna, a similar spot against the eye opposite the ocelli, and another similar spot against the eye near the extreme rear of the head; occipital crest with or without a reddish brown spot on either end. Antenna very dark brown or black. Rear of head black; a very narrow margin of dark brown against the eyes.

Prothorax black; extreme anterior border, posterior lateral margins of middle lobe, and extreme border of hind lobe, brown; a minute scarcely discernible brown spot on either side of the middle lobe at its posterior border. Propleuron with its anterior third black, posterior two-thirds reddish brown.

Thorax above metallic red black, mesepimeron largely the same color, shading at the borders into black or the darker area entirely black; the metathorax

[8]In other views a minute, dorso-internal, shining tubercle or low tooth may be detected on it.

[9]Proc. Acad. Nat. Sci. Phila., p. 137, (January, 1901).

is reddish brown, about the color of the pale markings on the mesothorax, shading into paler reddish brown below, with the dark areas black.

Abdomen largely bright red; segment one is black, with an apical dorsal yellowish red spot separated from or joined with a large apical lateral spot of more yellowish color, which in turn is separated from or joined with a still more yellow pale inferior longitudinal stripe; segment two with a narrow basal ring and two to ten with narrow apical rings black, brown on ten; nine with a large dorsal basal black spot on two-thirds of its length, this spot joined with or separate from a lateral spot of similar extent, which, on the extreme lower border, is produced posteriorly and joins the apical ring; ten basally black above for nearly half its length, the spot longest in the mid-dorsal line; sides of two above the genitalia narrowly yellowish, above this a broad black band continuous basally and apically with the black rings; three to eight with the extreme lower lateral edge very narrowly yellow, above this a black stripe the length of each segment, progressively wider from three to eight. Ventral suture black. Appendages dark reddish brown, darker at apex.

Legs black, femora paler inside basally, and tibiae externally with a light brown or yellowish line the entire length; tooth on tarsal claw small, better developed than in *esthera*.

Wings tinged with yellowish brown beyond the arculus, except in one specimen in which they are clear; they are very pale in two others; stigma brown, almost or quite covering one cell, its costal length equal to or slightly more than twice its width. In two right front wings $Cu_1$ all but reaches the cross-vein descending from the first postnodal. In the left hind wing of one of the same specimens there is a transverse cross-vein in the distal triangular cell posterior to $Cu_1$; and in the left hind wing of the other specimen the descending cross-vein from the first postnodal forks, the proximal branch ending against $Cu_1$ which continues to the wing margin, while the distal branch reaches the wing margin distally to the termination of $Cu_1$, thus forming a four-sided cell.

♀.—Genae light brown. Labrum and rhinarium brown; labrum with a large median black area of indefinite pattern. Nasus black, a basal pale spot on either side. Frons in front brown. Frons above and vertex black, spotted as in the male and in addition a small spot in front of and against the median ocellus. Antenna with second joint black, remainder brown. Rear of head black, bordered with light dull yellow, this border only a little wider than the pale border in the ♂.

Thoracic colors similar to the male, only slightly duller.

Abdominal segment one similar to the male, but the pale colors are yellow, not reddish, segments two to six above dark reddish brown, this brown bordered below and subapically with black, the subapical black separated from the narrow apical ring by a wide ring of yellow or reddish yellow; on seven the homologous black areas are present, but the dorsum is light reddish or yellowish brown, unpigmented like the preceding segments; the dark borders to the dorsal color on either side of two to seven do not reach the apex or base of each segment and on the posterior segments especially are more or less separated by pale from the dorsal color; eight to ten black above, eight continuously, nine to ten except

at the apex which in each case is light reddish brown. Sides of two to eight, below the dark border of the dorsal color described above, with a longitudinal band of dull yellow, becoming reddish yellow on the posterior segments; below this yellow band on each segment is a parallel longitudinal band of black, about the same width as the pale band above it except on eight where it is not half as wide; below this black band the extreme lower edge of each segment (two to eight) is pale, light yellowish on the anterior segments, darker and reddish on the posterior segments; sides of nine largely black, reddish yellow apically; ten black at base, apical half or two-thirds reddish yellow. Ventral suture black.

Legs black, femora light gray inside, tibiae light yellowish outside.

Wings clear; stigma light brown, covering nearly one cell.

British Guiana: Wismar, January 31, 1912; Tumatumari, February 8 and 11, 1912: a total of fourteen males, one female. Named for Miss Myrth Shafer; see remarks under *mariana*.

*Type*.—♂; ♀, allotype; Wismar, January 31, 1912; in the writer's collection.

This species is most closely related to *mariana* which it very much resembles in color; see remarks under *mariana*.

Under *bilinearis* I have briefly described a small stream between Wismar and Christianburg where we took a number of interesting dragonflies. One of these was this brilliant and beautiful species. At low water stage the first stream above Tumatumari on the same side of the river is a small, slow, mud-bottomed woodland stream known as Cashew Creek. On the opposite side, the left bank of the river, there is a similar stream just below Tumatumari Falls. At these two streams also we found *myrthea*.

**Neoneura rubriventris** Selys (Figs. 13, 14, 48, 49, 50, 51, 86 and 103.)

Specimens from British Guiana agree fairly well with de Selys' description, and their identity with *rubriventris* is established by the figures of the appendages received from M. Menger. However, a male from Pará, Brazil, collected by Professor C. F. Baker and given me several years ago, shows remarkable differences in the color patterns of the head and thorax (compare fig. 13 and fig. 14). Both Mr. Kennedy and I have studied this specimen and independently, he studying penes, and I appendages and characters in general, we have concluded that the specimens from British Guiana and Pará are specifically identical.

Abdomen, ♂ 29 to 30 mm.: hind wing, ♂ 20 to 21.

♂.—Genae dull brown, similar to labrum. Labrum, rhinarium, nasus and frons in front, dull reddish brown, the last paler; labrum with lower margin

paler, without definite pattern; nasus with an ill-defined or wanting black spot in front on either side (well defined and with a median posterior spot in specimen from Pará). The following description of frons above and vertex applies to specimens from British Guiana only; dull reddish brown, with obscure ill-defined markings; frons above with an obscure or wanting black central spot; in one specimen a large triangular pale postocular spot on either side, this spot broken into two or three smaller spots in another specimen, reduced to a vestige in another and entirely wanting in a fourth specimen; a short transverse black bar on either side of the occipital crest on the rear of the head above; usually a trace of black at either end of the occipital crest, and a larger spot opposite it against the eye. The specimen from Pará is strikingly different: the head above is reddish yellow with an extensive and definite black pattern as follows: from the second joint of the antenna a bar runs forward and inward a short distance, then curves broadly backward and inward to meet its fellow of the opposite side, forming a low broad U, which is produced forward somewhat in the median line; black between and posterior to the ocelli, but not reaching the occipital crest; a small median pale spot just behind the lateral ocelli; from the median ocellus a short bar runs outward on either side not quite half way to the eye; from the lateral ocellus, but narrowly separated therefrom, an irregular bar runs outward and forward to meet the eye at about the level of the median ocellus; posterior to this bar the vertex is entirely black with the following exceptions: a large pale spot against the eye at the level of the lateral ocellus; a much smaller spot posterior to it, against the eye and near the posterior border; and a more or less quadrangular spot in the median line, lying in front of the occipital crest which is included. Antenna dull brown; apex of second joint and basal half of third joint paler (British Guiana); second joint black on inner face and third joint not paler basally (Pará). Rear of head more or less black about the foramen, pale adjoining the eyes (British Guiana); largely black, the pale border at the eyes narrow (Pará).

Prothorax light dull brown, apparently without definite color pattern, anterior and posterior edges slightly paler (British Guiana); largely black, reddish brown as follows: anterior border; a large semicircular spot on the lower side of the middle lobe and a slightly smaller spot behind this on the posterior border of the middle lobe; and the lateral tips of the hind lobe (Pará). Propleuron light dull brown.

Thorax light and dark brown with black markings (see fig. 13 and fig. 14); in the specimens from British Guiana several or no black markings along the mid-dorsal line; in one specimen from British Guiana an abbreviated black line on the second lateral suture.

Abdomen red; segment one with a small basal dorsal black spot, and inferior lateral elongated oblique spot, and above it a smaller apical one; two with an obscure inferior lateral stripe above the accessory genitalia, and an oblique spot, sometimes wanting, on either side of the median line at about two-thirds the length of the segment, sides below at extreme apex dusky; three to six with the extreme apex black ringed, seven or eight to ten duller,

obscure, at least in dried material with more or less dark in ill-defined pattern. Ventral suture black. Appendages dull dark red, superiors tending to black above and apically.

Legs light brown with very variable markings; femora and tibiae, especially the femora, may be thickly spotted with dark, or the femoral markings may be obscure or wanting, and the tibiae may be lined with black or be without markings, except the inner side of all the tibiae, which are invariably black (British Guiana). Darker, the first and second femora black dorsally except at the extreme base; ventral apical half of first femora black; most of the anterior dorsal surface of the first and second tibiae covered with a black line; hind femora heavily spotted (Pará).

Wings clear or, in one specimen, slightly tinged with yellowish beyond the arculus; stigma light reddish brown to dark reddish brown, covering slightly less than one cell, its costal length equal to or slightly less than twice its width.

British Guiana: all in 1912; Wismar, January 30; Rockstone, February 1; Tumatumari, February 9 and 11: a total of four males.

Brazil: Pará; collected by C. F. Baker; one male.

For further reference to this species see under *maria*.

**Neoneura esthera** new species (Figs. 16, 17, 18, 19, 52, 53, 54, 55, 87, 88 and 104.)

Abdomen, ♂ 25.5 to 27 mm., average 26; ♀ 22.5 to 23.5, average 22.9: hind wing, ♂ 16 to 17, average 16.6; ♀ 17.

♂.—Genae pale yellowish green. Labrum light or dark brownish red, paler below, a small black spot at center above. Rhinarium, nasus and frons in front and above similar to labrum or usually darker, almost black in some cases, nasus with a black, depressed spot on either side. Vertex brownish red, intricately marked with black, variable, ocelli surrounded by black, from the median ocellus a band usually runs outward and forward across the frons above, ending just inside the first joint of the antenna, this band with two enlargements, one against the eye, the other midway, and sometimes with its inner end, next the ocellus, obliterated; from each lateral ocellus a band runs to the eye, this band usually with an anterior branch along the eye to the antenna; posterior to the ocelli is a T-shaped spot, sometimes wanting, the stem very short, and directed posteriorly or sometimes wanting; on either side of this, at the end of the occipital crest, is a spot, midway between this spot and the eye is another spot, and in line with these two there is another spot against the eye; posterior to these spots on either side is a transverse bar of black which reaches the eye; rarely this bar and the two spots anterior to it, are more or less fused. Antenna brown, second joint darker with apex yellowish. Rear of head black, except a pale narrow border at the eyes.

Prothorax reddish yellow; front lobe with a longitudinal black bar on the mid-line and one on either side; median lobe with a median black line and a

posterior spot on either side, this spot opposite a larger spot on the posterior lobe. Propleuron black in front, border and posterior half reddish yellow.

Thorax red or reddish brown above, paler and duller below, in a few cases with traces of greenish, ventrally; black markings variable as follows: a more or less irregular mid-dorsal stripe, and irregular antehumeral, enlarged above, at the middle and below (where it is posthumeral), usually divided between the median and lower enlargements and nearly so in many cases between the upper and median enlargements; an inferior spot on the mesepimeron, which may be developed through all intermediate stages into a stripe for nearly the full length of the sclerite, this maximum development rare; a median round spot on the first lateral suture; a stripe on the second lateral suture, more or less interrupted below the upper rounded end: metepimeron more or less darkened in its median area.

Abdomen red, segments two to six brightest, segment one duller with a median basal black spot, and sides below, dusky or black; two with a longitudinal black or dark band, just dorsal to the accessory genitalia, and just above this a shorter sub-basal longitudinal bar, which may be fused or not, with the bar below it, base and apex very narrowly black; three to ten narrowly ringed apically with black, this obscure or diffuse generally on seven to ten; inferior lateral edge of three to six or seven black, brown, or yellow or red, variation probably due to postmortem changes; extreme ventral edge of three to six very narrowly pale yellow, more conspicuous in some specimens than in others; beginning on two is a trace of an obscure subapical lateral spot, which progressively posteriorly grows larger and more distinct, joining with the apical black ring to form on seven to nine a distinctly dark, but ill-defined apical area; seven to ten generally duller and more yellowish; apical half or more of eight and most of nine and ten sometimes largely black in lateral view, in which case ten is largely black throughout. Ventral suture black. Superior appendages black, brown at base and below; inferiors brown.

Legs light brown; femora with numerous darker brown mottlings, and apex darker, these brown markings sometimes fused to make the entire dorsal surface dark or black with the tibia dark basally, and on the ventral surface; tooth on tarsal claw minute, slightly larger than in *rubriventris*.

Wings clear or slightly tinged yellowish brown: stigma light yellowish brown to brown, covering less than one cell, its costal length not quite twice its width. In one right hind wing there is a transverse cross-vein in the triangular terminal cell behind $Cu_1$. In both hind wings of another, the right hind wings of two others, and both front wings of another, $Cu_1$ terminates at the border with the descending cross-vein from the first postnodal; in another right hind wing $Cu_1$ meets this descending cross-vein just below its middle in the marginal cell. In both front wings of one specimen, and in the right front wing of another there is a short floating vein as a continuation of A; in the latter specimen, both hind wings and the left front wing, and in both hind wings in another specimen, this floating vein is continued clear across the cell. Were this condition normal it might be described as $Cu_2$ terminating against the next descending cross-vein after the quadrangle. In the left front wing last mentioned above $Cu_2$

is farther represented by a floating vein half way across the cell basal to the terminal triangular cell behind $Cu_1$. In another specimen the descending cross-vein distal to the termination of $Cu_1$ is forked in both front wings, forming a triangular marginal cell, which is not reached however by $Cu_1$. In another specimen, in the left hind wing there is a transverse cross-vein in the marginal cell posterior to the subquadrangle.

♀.—Genae very light brown, almost white. Labrum light brown with a basal median spot and on either side at the extreme edge a basal spot, black. Rhinarium, nasus, frons and vertex brown or light brown; nasus with a spot in front on either side, another posterior to this at the base, and a longitudinal median band, black; frons in front with two black spots in front of the base of the antenna; frons above usually with a large brown spot on either side of the median line. The vertex has the black pattern of the male reduced almost to extinction; the band from each lateral ocellus to the eye is represented by only the reduced distal half; there is also a small spot at either end of the occipital crest; there are some very obscure dark shadings about the ocelli, and sometimes there is a spot against the eye, opposite the spot at the end of the occipital crest, and a shortened, reduced bar of black posterior to this. Antenna with second joint light brown, almost white, with the inner face darker or black; third joint pale at base shading quickly into dark brown. Rear of head very light dull yellow.

Prothorax light brown, patterned as in the ♂, spots somewhat reduced. Propleuron light brown, dusky ringed inside the pale border.

Thorax brown, darker above, patterned similar to the ♂, reduced, variable; the mid-dorsal stripe more or less interrupted into a row of spots, each spot halved by the pale mid-dorsal carina; the stripe on the second lateral suture reduced to a spot above.

Abdominal pattern similar to the ♂, with the general color brown instead of red, sides below on two to six light dull green.

Legs cream colored, femora with two indistinct brown blotches on the body and one at base and apex.

Wings clear; stigma light yellowish brown, covering less than one cell.

In the wings examined the terminations of $Cu_1$, A, and the descending cross-vein from the first postnodal are normal, in marked contrast to the conditions found in the males.

Costa Rica: Rio Liberia, January 10, 1910, (Tristán and Calvert); Rio Medio, east of Santa Cruz, January 20 and 22, 1910, (Calvert); Rio Diria, west of Santa Cruz, January 23 and 26, 1910, (Tristán and Calvert); Rio Diria, east of Santa Cruz, March, 1916, (Alfaro); Rio Santa Barbara, below town of same name, Guanacaste, January 28, 1910, (Tristán and Calvert); Rio Morote, Guanacaste, February, 1912, (Tristán); Rio Buena Vista, Guanacaste, February, 1912, (Tristán); Rio Sipance, Nicoya,Guanacaste, February, 1912, (Tristán); Santa Domingo, Rio Corozal, Golfo Dulce, May, 1913, (Tristán): a total of

thirty-two males, fourteen females seen by me, all from Dr. Calvert who has other specimens from the same localities.

Trinidad: Diegomartin River, February 29, and March 7, 1912; Cunapo River, February 27, 1912; San Juan, March 2, 1912: a total of thirty-one males, eight females.

*Type.*—♂; Rio Medio, east of Santa Cruz, Costa Rica; Jan. 22, 1910: ♀, allotype; Rio Santa Barbara, Costa Rica; Jan. 28, 1910; in the collection of P. P. Calvert at the Academy of Natural Sciences, Philadelphia. The specific name *esthera* has been suggested by Dr. P. P. Calvert for this species in honor of Senora Ester de Tristán, wife of Professor J. Fidel Tristán, Professor Tristán having participated in the collection of the first known lot of specimens in Guanacaste, Costa Rica, in January, 1910.

This species, in de Selys' grouping, belongs with *rubriventris*, *sylvatica*, and *rufithorax*. However, its closest relative is *amelia*, from which it is distinguished at once by the paler abdomen in both sexes. The following notes on living colors have been given me by Dr. Calvert: "♂.—Eyes dark brown with blue or green reflections above, changing rather abruptly to pale green with a black pseudopupilla below, upper surface of head predominantly black with reddish lines. Thorax above rather dull red with black markings; sides pale brown with black markings at sutures. Dorsum of abdomen: posterior end of one and nearly all of two to nine bright red, most of one and ten black, the latter with a pair of red spots; articulations each with a narrow transverse black ring; sides of apex of five and entire sides of six to nine blackish, black rising to dorsum subapically, and on eight and nine meeting in the median line. ♀.—Eyes olive green above, pale green below. Colors of head and thorax pale brown with black lines and stripes. Dorsum of abdominal segments one and two pale greenish, a pair of spots on one and a right-angled U, open anteriorly, on two, brown; dorsum of three to five pale red, of six to ten pale brown; intersegmental articulations from one to two to six to seven blackish, from seven to eight to nine to ten dull lavender; three to seven have a pair of transverse subapical darker brown lines; eight and especially nine a transverse apical brown stripe; four to seven an indistinct brown longitudinal line on each side; pectus and ventral surface of

abdomen pale green, almost whitish; sternites of two to eight black or with a black median line; appendages and ventral margin of genital valves brown. Legs pale greenish, black at knees."

This is the only species of *Neoneura* known from Trinidad, where it occurs along the smaller rapid streams. In Costa Rica, however, it was taken associated with *amelia*, its nearest relative, in at least three localities.

One male, in poor condition, from Santa Domingo, Rio Corozal, Golfo Dulce, Costa Rica, is probably unusually dark. The head in dorsal view is black with three or four small obscure pale spots on either side of the vertex, the prothorax and thorax are almost entirely black except beneath; the mesepisternum has on its lower half an orange stripe, wide below, narrowing and disappearing above, there is a dull light brown stripe behind the humeral and the two lateral sutures, and the latero-ventral carina is paler brown; the abdomen is not especially dark except that eight to ten are largely black in lateral view, especially below and apically, the dorsal basal red narrowing apically and reaching about two-thirds the length of eight and nine.

**Neoneura carnatica** Selys (Figs. 20, 21, 22, 23, 60, 61, 62, 63, 89 and 90.)

Cuba, all in Hagen Collection: one male, three females under a separate pin label, "*N. palustris*," male with pin label "Cuba," three females each with a written pin label, "Poey, Cuba," and a printed pin label "Hagen," two with a written pin label, "8. ♀," one with "14. ♀": three males, two females under a separate pin label "*N. carnatica*," one male and one female each with a single pin label "Cuba" (the female may be *maria*), one male and one female (latter with three last segments lost) each with a large written blue name label, a written label, "Cuba, Poey," a number label, "8. ♂" and "8. ♀" in each case, and the printed label "Hagen"; the remaining male like the last mentioned, but without the large blue label.

For a discussion of this species, see text under *maria*.

**Neoneura maria** Scudder (Figs. 24, 56, 57, 58, 59, 91 and 92.)

Material consisting of one male and three females in the Hagen collection, under the pin label *palustris*, not attached to any specimen, by whose arrangement I do not know, all seem to me

to be *carnatica*. Similarly grouped under the pin label *carnatica* are three males and two females which also are *carnatica*, except one rather teneral female with only the pin label "Cuba," which is probably *maria*. Among the Protoneurae Mr. Kennedy found another specimen which is really *maria*. This specimen is shrunken as though teneral, or originally preserved in alcohol. It had the abdominal color (nine and ten blue above) mentioned by de Selys as separating *carnatica* from *maria* (*maria* was known to de Selys only from Scudder's description), *carnatica* having nine largely black above. Inferring that this specimen was teneral, and detecting no structural differences I decided that *maria* and *carnatica* were ontogenetic stages in one species. However, I have later had the pleasure, through the kindness of Mr. Kahl, of studying the four males and one female of *maria* recorded by him from the Isle of Pines,[10] the locality of Scudder's types. I am still unable to find structural differences for separating the two species, in fact the appendages are identical to the smallest detail, and yet I am compelled to consider them two species, in spite of this and the identical and peculiar color pattern of the head and thorax, for the red of *carnatica* and the blue of *maria* are certainly not ontogenetic (the Carnegie Museum female was taken in copulation with one of the four males and the material is certainly quite as mature as some of the red specimens in the Hagen collection). Moreover, the difference in color pattern of the apical abdominal segments is constant, one pattern always associated with red coloration, the other pattern associated with blue coloration, and there is no ground for thinking that this pattern can be ontogenetic. It may be suggested that the position here taken, and also with reference to *ethela* and *sylvatica*, is not consistent with the position taken with reference to the different color forms considered one species under *rubriventris*. In the last case but one specimen of the divergent form is known (this is true also of *ethela*, see discussion under that species), while we have in the case of *maria* and *carnatica*, a considerable series of each. Moreover, in *rubriventris* the two extremes, strikingly different as they are, may reasonably be expected to be bridged when larger series are available. If such connecting forms are not discovered, when the species is better

[10]Annals Carnegie Museum, Vol. x, p. 521, (1916).

known, I believe some future student may properly propose a new name for the dark form; at the present such a course is not justified. In fact, other students at the present time may criticise my position in regarding as distinct two insects, in which I can detect no structural differences. Some more acute student may yet detect structural differences, and, in the meantime, supposing even that real structural differences do not exist, I regard as specifically distinct two adult dragonflies of the genus *Neoneura*, one of which is largely bright red and the other largely bright blue.

The Isle of Pines specimens are smaller than the specimen of the same species in the Hagen collection, which is about the same size as *carnatica*. With the material before me I am unable to give characters which I think will prove constant for the separation of the females of *carnatica* and *maria*. In the female from the Isle of Pines abdominal segment nine is black above, ten yellow; in a female, almost certainly *carnatica*, in the Hagen collection nine and ten are alike yellow, but this is a character possibly dependent on age, as the Hagen specimen is less mature than the other. The Hagen specimen is one of those mentioned above as included under the pin label *palustris*. The slightly teneral female under the label *carnatica*, which is probably *maria*, has nine largely brown above with indications that the entire dorsum might become darker with age. A mature female of *carnatica* in the Hagen collection unfortunately lacks the three last abdominal segments. In this specimen the thorax is distinctly red as in the male; the thorax of the equally mature *maria* from the Isle of Pines is bluish brown above, without a trace of red anywhere. The color pattern of the prothorax may offer specific characters, but one must have a larger amount of material than I have to decide this. In the maximum black, as it is found in the Isle of Pine males, the following black areas are present: a broad longitudinal median bar on front lobe (1), a posterior lateral spot on either side of the same lobe (2), a narrow longitudinal median bar on the middle lobe (3), a posterior mid-lateral spot on either side of the same lobe (4), the lateral margins of the same lobe (5), transverse anterior narrow stripe on the hind lobe (6), an anterior spot at either end of this (7). In *maria* males from Isle of Pines, 1 is very broad, 3 is relatively broad, 5 fuses with

6, and 4 fuses with 6. The females of *maria* from Isle of Pines and the Hagen male have the areas all present, but not fused as described above. But in *carnatica* males, areas 4, 6 and 7 are entirely wanting, 3 is scarcely evident, and 1 is reduced. In the female the same is true, except that 4 may be present.

Cuba: (Ch. Wright), one male, Hagen collection; and probably one female, with pin label "Cuba," in the same collection.

Isle of Pines: Nueva Gerona, May 6 and 9, (J. L. Graf), four males, one female, Carnegie Museum.

In Scudder's description of *maria*, the symbol ♀ is used instead of ♂ as intended, and line sixteen from the bottom of page 188, for *a narrow lateral stripe* read *a narrow dorsal stripe*.

**Neoneura amelia** Calvert (Figs. 25, 26, 64, 65, 93, 94 and 105.)

The male is very variable in the amount of black on head, thorax and first three abdominal segments. Scarcely any two have the same head pattern and occasionally it is even unsymmetrical. In dark males the head above has a large, median, roughly quadrangular black area posterior and lateral to the ocelli, from which area three bars run out on each side to the eye; the two anterior bars irregular with enlargements, and rarely, in the darkest examples, more or less fused with each other, and with the posterior bar; the posterior bar more regular, formed by the extension on the dorsum of the head of the black rear. There is also a more or less trident-shaped black figure in front of the median ocellus. Reduction in black is accomplished by a reduction of the two anterior bars mentioned above, which may be narrowed or broken into spots, by pale spots appearing in the large quadrangular black area, in some cases these pale spots fusing and obliterating all this dark area but an irregular longitudinal bar on either side, and by the trident reduced to a small spot on either side opposite the antenna and midway between the antenna and the median line. The sides of the thorax and of segments one to three may be largely, or in extreme cases, entirely black, or almost entirely pale with the black on the thorax reduced to narrow lines or spots. The extent of black is certainly determined partly but not entirely by age; the Guatemalan specimens average much darker than the Costa Rican, and a

teneral male from the former locality, in the head and thoracic markings is as dark as almost any of the Costa Rican specimens. No Guatemalan specimens seen by me have the thoracic black as reduced as it frequently is in Costa Rican specimens. Specimens from San Tomas, Guatemala, are especially dark. These specimens were taken at a large spring at approximately sea-level. Structurally the males of *amelia* are most easily separated from the males of *esthera* by the inferior appendages, which are acute in profile view in *amelia* and are broader with the apex semicircular in *esthera*. A male of *amelia* from Santa Barbara has the abdomen 28.5 mm., the hind wing 18.

The female of *amelia* has the head above very variable as in the male; usually, in addition to the spots described by Calvert, there are traces of the apices of the two lateral prongs of the trident described above in the male, and there is a black spot at either end of the occipital crest. The thorax is pale with reduced black markings, and with little or no variation, as contrasted with the great variability of the male.

GUATEMALA: all in 1909, Morales, May 27; Puerto Barrios, May 28; San Tomas, May 29; Gualan, June 14; Los Amates, June 19 and 21; a total of sixty-one males, five females.

COSTA RICA: Rio Cieniguita, November 4, 1909, (Calvert); Agua Buena Creek, in forest, Holanda Farm, November 7, 1909, (Calvert); Rio Bananito, November 10, 1909 ,(Calvert); Rio Liberia, January 10, 1910, (Tristán and Calvert); Rio Medio, east of Santa Cruz, January 22, 1910, (Calvert); Rio Santa Barbara, below the town of the same name, Guanacaste, January 28, 1910, (Tristán and Calvert); a total of fourteen males, two females, seen by me, others in Calvert's collection.

The following notes on living colors have kindly been given me by Dr. Calvert. "♂.—Eyes reddish brown above gradually blending into pale green with a black pseudopupilla below. Upper surfaces of head (including labrum), thorax and first three abdominal segments bright red with black markings. Labrum pale luteous. Rear of head black, pale yellow along eye margins. Sides of thorax brown with black markings at the sutures. Sides of abdominal segments 2 and 3 and almost all of 4–10 black; 4–7 with a transverse basal narrow ring and a confluent mid-dorsal longitudinal line almost as long as each segment, yellow. Ventral

edges of tergites of 1–8 pale green. Hind part of 10 transversely pale brown or 10 all black.

" ♀.—Eyes greenish-gray with 1 or more black pseudopupillae; darker in upper half. Body generally olive-gray, paler on clypeus and labrum. All regions of body with narrow black markings. Hind fourth of 3–6 and most of dorsum of 7–10 reddish brown, or olive-brown tinted lightly with red on 3 and 4."

**Neoneura aaroni** Calvert (Figs. 27, 28, 29, 66, 67, 95 and 96.)

The great variation in color due to age has been fully described by Dr. Calvert.[11] In addition to the original material, I have collected the species at Black Bayou, Texas.[12] In the left hind wing of one male the descending cross-vein from the first postnodal ends on $Cu_1$, just before the termination of the latter at the wing margin. In the right hind wing of the same specimen the terminal triangular cell behind $Cu_1$ has an added transverse cross-vein.

**Neoneura paya** Calvert (Figs. 30, 68, 69, 97 and 106.)

Guatemala: San Tomas, May 29, 1909; Los Amates, June 19, 1909: a total of eleven males. Unfortunately the unknown female was not taken. At the big spring at San Tomas, where the washerwomen congregate, and along the Rio San Francisco below Los Amates, this species was taken associated with *N. amelia*.

**Neoneura fulvicollis** Selys (Figs. 15, 70, 71, 72, 73, 74 and 98.)

I have seen the two males in the Carnegie Museum.[13]

Some Venational Characters of Fifteen Species of *Neoneura*, Expressed in Percentages.

(Based on the following material: *joana*, 10♂, 2♀; *bilinearis*, 10♂, 2♀; *sylvatica*, 3♂; *ethela*, 1♂; *mariana*, 5♂, 1♀; *denticulata*, 1♂; *myrthea*, 10♂, 1♀; *rubriventris*, 5♂; *esthera*, 10♂, 5♀; *carnatica*, 4♂, 3♀; *maria*, 5♂, 1♀; *amelia*, 5♂, 4♀; *aaroni*, 2♂, 1♀; *paya*, 5♂; *fulvicollis*, 2♂.)

[11]Biol. Cent.-Amer., pp. 139 to 140 and 392.
[12]Ent. News, xxv, p. 446, (Dec., 1914).
[13]Calvert, Ann. Carneg. Mus., vi, p. 212.

| | JOANA | BILINEARIS | SYLVATICA | ETHELA | MARIANA | DENTICULATA | MYRTHEA | RUBRIVENTRIS | ESTHERA | CARNATICA | MARIA | AMELIA | AARONI | PAYA | FULVICOLLIS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $M_2$ front wing arising at or near the third postnodal | | ♂-5 | | | ♂-60 ♀-100 | | | | | | | | | | |
| midway between third and fourth postnodal | ♂-5 | ♂-15 ♀-25 | | | | | | | | | | | | | |
| at or near fourth postnodal | ♂-95 ♀-100 | ♂-80 ♀-75 | ♂-100 | ♂-50 | ♂-30 | ♂-100 | ♂-100 ♀-100 | ♂-100 | ♂-100 ♀-100 | ♂-100 ♀-67 | ♂-100 ♀-100 | ♂-100 ♀-100 | ♂-100 ♀-100 | ♂-100 | ♂-100 |
| at or near fifth postnodal | | | | ♂-50 | ♂-10 | | | | | ♀-33 | | | | | |
| $M_2$ hind wing arising at or near the second postnodal | | | | | ♂-10 | | | | | | | | | | |
| at or near third postnodal | ♂-100 ♀-100 | ♂-100 ♀-100 | ♂-100 | ♂-50 | ♂-90 ♀-100 | ♂-100 | ♂-100 ♀-100 | ♂-100 | ♂-100 ♀-100 | ♂-100 ♀-83 | ♂-100 ♀-100 | ♂-100 ♀-100 | ♂-100 ♀-100 | ♂-100 | ♂-100 |
| at or near fourth postnodal | | | | ♂-50 | | | | | | ♀-17 | | | | | |
| $M_{1a}$ front wing arising at fifth postnodal | | | | | ♂-20 ♀-50 | | ♂-5 | | | | | | ♂-25 | | |
| at sixth postnodal | | ♂-40 | | | ♂-50 ♀-50 | ♂-100 | ♂-95 ♀-100 | | ♂-20 ♀-20 | ♂-63 | ♂-30 | ♂-60 ♀-50 | ♂-75 | | ♂-50 |
| at seventh postnodal | ♂-40 | ♂-60 ♀-100 | | ♂-50 | ♂-10 | | | ♂-90 | ♂-80 ♀-80 | ♂-37 ♀-100 | ♂-70 ♀-100 | ♂-40 ♀-50 | ♀-100 | ♂-100 | ♂-50 |
| at eighth postnodal | ♂-60 ♀-100 | | ♂-83 | ♂-50 | ♂-20 | | | ♂-10 | | | | | | | |
| at ninth postnodal | | | ♂-17 | | | | | | | | | | | | |
| $M_{1a}$ hind wing arising at fourth postnodal | | | | | | | ♂-10 | | | | | | ♂-25 | | |
| at fifth postnodal | | ♂-15 | | | ♂-50 ♀-100 | ♂-100 | ♂-90 ♀-50 | ♂-20 | ♂-10 | ♂-25 ♀-33 | ♂-30 | ♂-20 | ♂-75 | | |
| at sixth postnodal | ♂-5 | ♂-85 ♀-75 | | ♂-50 | ♂-40 | | ♀50 | ♂-80 | ♂-75 ♀-100 | ♂-75 ♀-33 | ♂-70 ♀-100 | ♂-80 ♀-100 | ♀-100 | ♂-100 | ♂-50 |
| at seventh postnodal | ♂-95 ♀-100 | ♀-25 | ♂-100 | ♂-50 | ♂-10 | | | | ♂-15 | ♀-33 | | | | | ♂-50 |

EXPLANATION OF PLATES

All figures drawn by C. H. Kennedy except where otherwise indicated.

## Plate IX

Diagrams of thoracic color patterns.

Fig. 1.—*Neoneura joana*, type ♂, Tumatumari, British Guiana, February 11, 1912.
Fig. 2.—*Neoneura joana*, allotype ♀, Tumatumari, British Guiana, February 7, 1912.
Fig. 3.—*Neoneura bilinearis* ♂, Wismar, British Guiana, January 30, 1912.
Fig. 4.—*Neoneura bilinearis* ♂, Poco Grand, Brazil, December 28, 1897, Coll. Cornell Univ.
Fig. 5.—*Neoneura bilinearis* ♀, Wismar, British Guiana, January 31, 1912.
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## Plate X

Diagrams of thoracic color patterns.

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Fig. 9.—*Neoneura mariana*, allotype ♀, Potaro Landing, British Guiana, February 10, 1912.
Fig. 10.—*Neoneura denticulata*, type ♂, Iquitos, Peru, (Staudinger), Hagen Coll.
Fig. 11.—*Neoneura myrthea*, type ♂, Wismar, British Guiana, January 31, 1912.
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## Plate XI

Diagrams of thoracic color patterns.

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Fig. 14.—*Neoneura rubriventris* ♂, Pará, Brazil, (C. F. Baker).
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Fig. 16.—*Neoneura esthera*, Cunapo River, Trinidad, February 27, 1912.
Fig. 17.—*Neoneura esthera*, type ♂, Rio Medio, east of Santa Cruz, Costa Rica, January 22, 1910.
Fig. 18.—*Neoneura esthera*, Diegomartin River, Trinidad, February 29 1912.

## Plate XII

Diagrams of thoracic color patterns.

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Fig. 20.—*Neoneura carnatica* ♂, Cuba, (Poey), 1864, Hagen Coll.
Fig. 21.—*Neoneura carnatica* ♂, Cuba, under label *palustris*, Hagen Coll.
Fig. 22.—*Neoneura carnatica* ♀, Cuba, (Poey), 1864, Hagen Coll.
Fig. 23.—*Neoneura carnatica* ♀, Cuba, (Poey), 1866, under label *palustris*, Hagen Coll.
Fig. 24.—*Neoneura maria* ♂, Cuba, (C. H. Wright), Hagen Coll.

## Plate XIII

Diagrams of thoracic color patterns.

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Fig. 26.—*Neoneura amelia* ♀, Los Amates, Guatemala, June 19, 1909.
Fig. 27.—*Neoneura aaroni* ♂, Black Bayou, Texas, May 17, 1907.
Fig. 28.—*Neoneura aaroni* ♂, Texas (Calvert, Biol. Cent.-Amer., p. 139, Coll. E. B. W.).
Fig. 29.—*Neoneura aaroni* ♀, Texas (Calvert, Biol. Cent.-Amer., p. 139, Coll. E. B. W.).
Fig. 30.—*Neoneura paya* ♂, Los Amates, Guatemala, June 19, 1909.

## Plate XIV

Male abdominal appendages.

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Figs. 33 and 34.—*Neoneura bilinearis*, Wismar, British Guiana, January 30, 1912.
Figs. 35 and 36.—*Neoneura bilinearis*, Poco Grand, Brazil, December 28, 1897, Coll. Cornell Univ.
Figs. 37, 38 and 39.—*Neoneura sylvatica*, Chapada, Brazil, Coll. Carnegie Mus. (Calvert, Ann. Carneg. Mus., vi, p. 212); 39, apex of abdomen, seen directly from behind.
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Male abdominal appendages.

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Fig. 82.—*Neoneura mariana*, allotype ♀, Potaro Landing, British Guiana, February 10, 1912.
Fig. 83.—*Neoneura denticulata*, type ♂, Iquitos, Peru, (Staudinger), Hagen Coll.

Fig. 84.—*Neoneura myrthea*, type ♂, Wismar, British Guiana, January 31, 1912.
Fig. 85.—*Neoneura myrthea*, allotype ♀, Wismar, British Guiana, January 31, 1912.
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Wing photographs by Mr. Munz.

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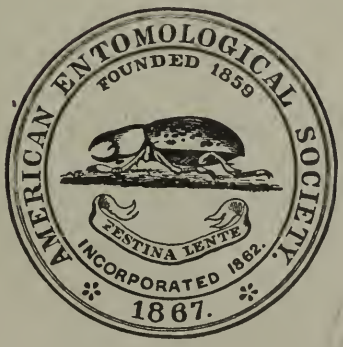


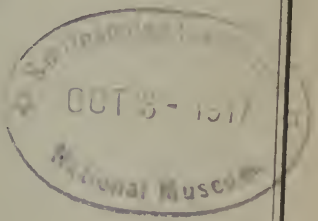


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# CONTRIBUTIONS TOWARD A MONOGRAPH OF THE MUTILLIDAE AND THEIR ALLIES OF AMERICA NORTH OF MEXICO

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Smithsonian OCT

## IV. A REVIEW OF THE MYRMOSIDAE

The term Myrmosidae is here used in the exact sense in which it was applied by Dr. Ashmead, that is to include those Scolioid wasps which in the female sex are always wingless and have the thorax divided into two distinct parts (as contrasted with three in Thynnidae or the entirely undivided condition of the Mutillidae), and which in the male sex are distinguished from Mutillidae by the possession of an anal lobe on their hind wings, but possess no very definite characters distinct from the Thynnidae. It is very doubtful whether the females provisionally associated with *Brachycistis* really belong there, and until the female sex of that genus is known, its status in the Myrmosidae must remain an open question.

I make use of the family group Myrmosidae tentatively and merely as a matter of convenience, without wishing to express any convictions concerning its limits, or the advisability of recognizing it as a distinct family.

It may not be out of place to note, however, that the middle coxae of *Chyphotes* are widely separated, which would throw them into the Thynnidae by Dr. Ashmead's tables, that the wing venation of *Brachycistis* (figure 5), *Typhoctes* (figure 3), and *Chyphotes* (figure 4), are of a type very different from that of *Myrmosa* (figure 2), which is on the contrary more analogous to that of *Methoca* in the Thynnidae, or of *Telephoromyia* and other Thynnidae. While the hypopygium of *Myrmosa* is unarmed, *Brachycistis*, *Typhoctes*, and *Chyphotes*, as well as *Methoca* in the Thynnidae, have their hypopygia armed with a recurved aculeus similar to that of *Elis* [=*Plesia* and *Myzine*].

In this paper, as in the others of the series, I have entered the synonymy of each species only in so far as it differs from, or is

additional to, that given by Fox in his Monograph.[1] The color nomenclature is, for the most part, that of Mr. Robert Ridgway.[2]

## A Key to the Genera of Myrmosidae known to occur in America north of Mexico

1. Ocelli of the female present; hypopygium of the male unarmed; marginal cell of the fore-wings long, reaching nearly to the apex of the wing (figure 2); posterior coxae each with a prominent lamina on its upper surface at base..... **Myrmosa** Latreille

   Ocelli of the female absent; hypopygium of the male armed with an aculeus; marginal cell extending but a short distance beyond the stigma, or ending in it (figure 5)..... (2)

2. Middle tibiae with two apical spurs; in the males the first abdominal segment consisting of a basal petiolar portion and an apical more or less gibbous portion, the two separated by a transverse suture; mesosternum of the males without a caudal lamella on each side of the middle projecting over the base of the coxa..... (3)

   Middle tibiae with one apical spur; basal abdominal segment not consisting of two parts; mesosternum with a prominent caudal lamella on each side of the middle encasing the base of the coxa. (Males.)..**Brachycistis** Fox

3. Abdomen petiolate; posterior coxae simple..... (4)

   Abdomen sessile; posterior coxae each with a prominent lamina on its upper surface at base. (Females)..... **Brachycistis** Fox (?)

4. Front wings with the transverse part of $M_2$ wanting; the cell $R_5$ about one-half the size of the cell R + 1st $R_1$; $R_5$ present and not far apicad of the radial cross-vein (figure 3); the first abdominal segment of the female greatly widened before the apex..... **Typhoctes** Ashmead

   Front wings with $M_2$ complete; the cell $R_5$ joined with $R_4$, the vein $R_4$ far apicad of the radial cross-vein, the two united cells thus nearly as long as the cell R + 1st $R_1$, or in some cases both cells $R_4$ and $R_5$ present and distinct (figure 4); petiole of the females filiform throughout.
   **Chyphotes** Blake

### MYRMOSA Latreille

Type: *Mutilla nigra* Rossi, = *M. melanocephala* Fabricius. *Myrmosa* was originally described without included species, and *Mutilla nigra* was placed in it by Latreille in 1802.

[1] The North American Mutillidae. By William J. Fox. Transactions of the American Entomological Society. 1899. 25: 219 to 292.

[2] Color Standards and Color Nomenclature. By Robert Ridgway, Washington, D. C., published by the Author, 1912. 3 p. l., iv, 44 p., 53 col. pl., 22 cm.

## A Key to the Subgenera

### *Males*

1. $R_5$ opposite the radial cross-vein; cell $R_5$ triangular, no longer than cell $R_4$ (figure 2); pygidial segment toward the apex with a deep longitudinal furrow, making it appear as though divided into two lobes, the apex lobed; first ventral segment armed with a recurved hook, the second with a tubercle or hook at base; clypeus flat, with a longitudinal median keel below the antennae.....**Myrmosa** Latreille

   $R_5$ far apicad of the radial cross-vein; cell $R_5$ not triangular, longer than cell $R_4$ (figure 1); pygidial segment tapering to the almost acute, very slightly notched apex, without a longitudinal impression; first and second ventral segments simple; clypeus convex, without a keel.

   **Myrmosula** new subgenus

### *Females*

In this sex no division of the genus is known, the species are therefore all recorded under the typical subgenus *Myrmosa* Latreille.

## A Key to the Species of the Subgenus Myrmosa known to occur in America north of Mexico

### *Males*

Pubescence white. (Eastern.).....**unicolor** Say
Pubescence black. (Californian.).....*species non descripta*

### *Females*

1. Anterior half of the second dorsal segment closely punctured.....(2)

   Anterior half of the second dorsal segment polished and shining, with only few and scattered punctures. Length 3 to 5 mm.....**banksi** new species

2. Basal abdominal segment with a transverse dorsal carina; posterior metatarsi with prominent spines; posterior tibiae with two or three rows of very prominent spines. Length 6 to 8 mm.....**unicolor** Say

   Basal abdominal segment without such a carina; posterior metatarsi without noticeable spines (there are a few largely hidden by pubescence); posterior tibiae with fewer spines, these small and inconspicuous. Length 4 mm.....**blakei** new species

**Myrmosa (Myrmosa) unicolor** Say, ♂, ♀.

1886. *Mutilla thoracica* Blake, Trans. Amer. Ent. Soc., 13:204, ♀.

Professor Melander is doubtless correct in associating *thoracica* with *unicolor*. He remarks upon the occurrence of the females in gravel pits among the numerous burrows of *Halictus*, and my own specimens come from exactly similar situations.

Massachusetts: Woods Hole, common, (A. L. Melander). New York: Rochester Junction, June 19, 30, July 11, 1914, 4 ♂, (M. D. Leonard), [Cornell University]; Ithaca, August 6, 1885, 1 ♂, (E. H. Sargent), [Cornell University]; June 24, 1900, 1 ♂, [Cornell University]; August, 1916, 1 ♀, (the author), [Cornell University]; McLean, Cortland County, August, 1916, (the author), [Cornell University]; Rhinebeck, July 27, 1907, 1 ♂, (C. R. Crosby), [Cornell University]. Pennsylvania. Virginia: Falls Church, June 27, 30, July 4, 5, 14, 20, 21, 28, September 4, 12 ♂, August 2, 4, 11, 17, September 7, 5 ♀, (N. Banks), [N. Banks and Cornell University]; Glencarlyn, July 11, 26, 3 ♂, (N. Banks), [N. Banks]; High Island, June 23, 1 ♂, (N. Banks), [N. Banks]; Great Falls, June 25, 3 ♂, (N. Banks), [N. Banks]. Illinois: Lake County, common, (A. L. Melander). "Northwest Territory" (Say). Fox states Canada and Virginia westward to Colorado.

This is evidently a species essentially of the Carolinian Fauna. Where it extends into the Transition, as at Ithaca, it is of very rare occurrence. Rochester Junction, in New York State, where it is more common, is a region distinctly more Carolinian in its tendencies.

**Myrmosa (Myrmosa) banksi** new species, ♀.

♀. Mahogany red, the abdomen except tip of first segment reddish black, legs a trifle more pallid, head a little darker; clothed with only minute and sparse pubescence. Length, 3.2 mm.; paratypes, 3.4 mm.

Head much rounded, narrowed behind the eyes, very sparsely and minutely punctulate; ocelli minute, about .02 mm. in diameter, the posterior pair .15 mm. from each other and .28 mm. from the eyes; face with a prominent spine between the antennae; border of clypeus not margined. First segment of the flagellum as broad as long, equal to the pedicel and shorter than the second segment.

Thorax with its sides contracted well toward the caudal end, but not strongly; the dorsum finely rugulose; lateral pieces of pronotum striolate; pleura impunctate and polished; caudal aspect of propodeum smooth and polished.

Petiole smooth and polished, toward its apex with two transverse, sinuous ridges, beyond which it is minutely punctulate, ventrally it bears a short thin keel, which is truncate in front and behind and notched beneath; second and following segments minutely and very sparsely punctulate, polished: pygidium with setigerous punctulations at its base.

The paratypes generally have the head a trifle less finely punctulate, but sparsely so; the thorax and first abdominal segment sometimes Sanford's brown. Two specimens from Pennsylvania, presumably of this species, differ in being considerably larger, about 5 mm. in length, and with the head rather coarsely punctured, in one of them both closely and coarsely punctured.

*Type material.*—Holotype: *Virginia:* Falls Church, August 11, (Nathan Banks), [Cornell University, No. 128.1]. Fourteen paratopotypes, August 7, 11 and 14, (N. Banks), [N. Banks and Cornell University].

Two specimens from Beatty, Pennsylvania, [Amer. Ent. Soc.] may be different.

**Myrmosa (Myrmosa) blakei** new species, ♀.

♀. Mahogany red; a large transverse spot on the second dorsal segment, and the entire dorsal segments 3 to 6, black; apical ventral segments, legs more or less, and the front, infuscated; pubescence sparse and inconspicuous, rather noticeable on the apex of the first dorsal segment. Length, 4 mm.

Head large, subquadrate, long and broad behind the eyes, closely but shallowly punctate; ocelli small, about .05 mm. in diameter, the posterior pair .26 mm. from each other and .40 mm. from the eyes; a blunt compressed spine on the face between the antennae; anterior edge of clypeus prominently margined. First segment of the flagellum broader than long, equal to the pedicel, shorter than the second.

Outline of thorax rectangular, with a sharp incision at the metathoracic spiracles; the humeral angles sharp; the postero-lateral angles dentate; side pieces of pronotum punctate, merging into striate; pleura mostly impunctate and polished, in one place punctate; caudal aspect of propodeum truncate above, sloping below, smooth and polished, margined superiorly with a semicircle of nine flattened teeth.

Petiole with its apical part rough, ventrally with a sharp keel which is weakly notched, second segment regularly, moderately strongly, and closely punctate; pygidium rather closely punctulate at base.

*Type.*—New York, [American Entomological Society].

**Myrmosa (Myrmosa)** *species non descripta*

A single male from Exeter, California, collected by the writer, July 30, 1907, represents an undescribed species. As the specimen has lost its head, I refrain from describing it, but have compared it with *unicolor* in the above short key, for the information of those who may be so fortunate as to find additional specimens in the field or amongst the material already in their collections.

## A Key to the Species of the Subgenus Myrmosula

Insect black, at most with the tip of the abdomen reddish; cell $R_4$ narrowed above, higher than long ..... **parvula** Fox

Head, thorax, and legs black, abdomen ferruginous; cell $R_4$ quadrate, longer than high ..... **rufiventris** Blake

**Myrmosa (Myrmosula) parvula** Fox, ♂.

Georgia: Atlanta, August 2, 1913, 1 ♂, (the author), [Cornell University]. Illinois. Montana.

**Myrmosa rufiventris** Blake, ♂.

Nevada.

## BRACHYCISTIS Fox

A study of the males of the genus *Brachycistis* reveals the existence of numerous unsuspected, and in some cases very well marked, characters for the separation of many of the species. The best of these characters are to be found in the genitalia, and especially is this true of the group of species allied to *castanea*, in which the genital characters are very strongly marked. Externally visible and striking differences led me to make dissections of these organs in most of our species, with fortunate results, although in the major series of species there is quite a uniformity of structure. It is in these species that other structures are in general more monotonous, and good structural specific characters that can be readily formulated, difficult to find, while in those with the striking genitalic differences, correspondingly strong peculiarities of other structures are frequent. In other words the latter doubtless represent well established, distinct and stable species, while the former represents the greater mass of evolutionarily more active, plastic, and less firmly established species. It is not surprising in such forms to find a lack of stability, even in characters that in the former group seem to be entirely fixed and thoroughly dependable for denoting specific limits.

The purpose of the present task has been to study the types of the existing species, with a view to establishing characters that would make their specific differentiation definite, and to describe and include such additional species as are represented in the material before me. From the previously existing keys it is not possible to identify some of the type specimens themselves, and I believe considerable confusion and misidentification must have resulted from their use. Interesting as the task would be, the limits of time have not permitted an attempt to study the large amount of material of this genus that must exist in the various collections in this country, nor has any special attempt been

made to collect material. Thus the present paper can be looked upon only as affording what I trust will prove a firm foundation for a knowledge of the genus, and as neither exhaustive, nor in any sense complete.

It is probable that there exist in the southwest very many species of this genus that remain unknown, and that the distribution of many, if not most of the species is decidedly restricted. Therefore, in order to prevent confusion in the future, it has seemed to me all the more important to review at this time our existing species from type material, and to establish more fully their specific characteristics. In drawing up the descriptions of the new species I have followed throughout one form, which includes only characters that have proved to differ in different species. Of course some of these characters will vary within the limits of certain species and remain constant in others, and there are series of species alike in certain characters which differ in only a few, but I think it would not be presumptuous to suggest that future describers of species within this genus should not omit any of the characters mentioned in, let us say, the description of *B. crassa* below.

The meagerness of our actual knowledge of *Brachycistis* is shown by the fact that as yet we do not know with certainty a single female. The two species included by Fox tentatively in this genus, although without any conviction that they really belonged there, I shall leave there, for lack of definite evidence to the contrary. However, there are two reasons, besides the one mentioned by Fox, why I do not believe that they can belong to *Brachycistis*. The first is that while one of these species was described from Missouri, and I have since seen specimens in the collection of Mr. Nathan Banks from Virginia, males of *Brachycistis* are not known from east of the Mississippi River. It is hardly probable that the tolerably common and easily collected winged males, flying as they do to light in numbers, would be entirely overlooked by our eastern collectors, while only the females which must be very rare, or at least by their obscure habits difficult to collect, found. The other reason is that the females described as *B. rutilans* and *B. bimaculatus* possess a peculiar leaflike expansion of the posterior coxae, which does not occur in the males, but which does occur in both the males and

females of *Myrmosa*. As to what these females really are, I can only suggest that they may represent the female sex of those species heretofore included in the genus *Myrmosa*, but for which is established in this paper the subgenus *Myrmosula*, or, more probably, a genus of which the males are as yet entirely unknown.

The females to which reference has just been made have been suspected by Ashmead of belonging to the genus *Milluta* of André. That genus was based on a palearctic species unknown to me, and may have valid claims for recognition on the basis of other characters than those stated. Although some of our species possess the chief characters on which this genus is said to be based, I can not believe that they form by themselves a section worthy of generic or even subgeneric rank. However, none of them possess toothed tarsal claws, as in *Milluta*, and I believe the latter genus will have to be restricted to the palearctic species on the basis of this distinction, and possibly others, perhaps in the genitalia, as yet unknown.

### The Characters of the Males of Brachycistis

Most frequent color brownish orange to castaneous, or mahogany red, often with the head black and sometimes wholly black; other colors not known. Wings hyaline or slightly infuscated beyond the stigma. Length from 6 to 20 mm. The colors seem quite constant specifically, the black on the thorax, however, sometimes varying to dark red. They are clothed with sparse, erect, usually yellowish pubescence, thickest on the pronotum, caudal face of the propodeum, sides of the petiole, and abdominal segments, where it is arranged in sinuous, closely set, transverse rows, one on each segment.

The head is transverse, more or less narrowed behind the eyes, which are very large, bead-like, round, and reach the mandibles. Ocelli usually large and prominent, but sometimes small and not prominent. Their size and distance from the eyes and from each other afford very important specific characters. Under the specific description the measurements of the ocelli are given in the following order: narrowest diameter of the posterior ocelli, distance from the eyes, distance from each other. The anterior ocellus is transverse, and often larger than the others; the posterior are somewhat obliquely placed, and by reason of being

inserted on the lateral slope of a raised prominence of the vertex, they face nearly laterad rather than dorsad, in most but not all species. The forehead is sometimes raised medially above the antennae, again flat, and often armed with a transverse row of four tubercles, the two lateral sometimes developed into carinae. The inferior border of each antennal socket is sometimes thickened, and produced ventrally into a triangular tubercle, or into a flattened curved ridge. The anterior margin of the clypeus is of varying form, most frequently emarginate. The mandibles are robust, strongly curved, with three teeth, of which the apical is the longest. From the inner tooth a carina extends toward the base of the mandible, usually in a broad curve, its length and shape varying in the species. In three it is elevated into a tooth close to the base. The width of the gular orifice varies in different species, and in some it is laterally immargined, in others margined, and the margins sometimes produced into prominent reflexed processes. The maxillary palpi are six-segmented and the labial four. The first three segments of the latter are sometimes widened and triangular. The antennae are filiform, usually crenulated, sometimes very strongly so, as in *stygia*, sometimes not noticeably so; occasionally the segments are much elongated. I have not noted much variation in their proportions. The scape is short, globose and punctate, the pedicel very short, hardly half as long as wide; the third segment about one and one-half times as long as the scape and equal in length to the fourth. The surface of the head is always polished and always with sparse, usually very sparse and small punctures, sometimes moderately coarse and less sparse.

The humeral angles are sometimes prominent, more often not in evidence, being entirely rounded. The mesonotum always has well marked parapsidal furrows, and is frequently much depressed before the scutellum. Its surface is most often sparsely, rarely rather densely punctured. The scutellum is subquadrate, only slightly convex, its disc usually with sparse punctures, and its sides, like those of the post-scutellum, often with minute close punctulations. The mesopleura are always strongly convex, and in many species marked with peculiar rugosities, sometimes with an impressed basin which may be surrounded by a rim or tubercles, while often there is a deep pit near the upper

posterior border. The middle coxae are each covered at base with a scale-like projection of the mesosternum, and there is a similar, thicker projection of the metasternum at the base of each posterior coxa, differing slightly in form in different species. The propodeum usually has definite dorsal, caudal and lateral faces, the two former separated in some groups of species by a strong transverse carina, an important specific character. In rare cases the propodeum is very low, entirely rounded, and without definite faces; sometimes the hind angles are prominent and punctured or rugose, but are usually rounded and only slightly roughened. The dorsal face is generally polished, without sculpture, or with a median channel; the posterior face is roughened by the insertion of numerous erect hairs, as are also the upper parts of the sides. The dorsal face is usually strongly declivous.

The wings present important specific characters. They all agree in having the venation terminate not more than two-thirds of the way from base to apex, the rest being free membrane (figures 5 to 20). The length of the stigma, and the length and shape of the marginal cell ($2dR_1+R_2$) are variable among the different species, in fact the former has been made a chief character for distinguishing André's genus *Milluta* from *Brachycistis* (compare figures 20, 12, 8 and 11). The cell $R_4$ is in rare cases not enclosed (figures 9 and 20). Its height as compared with its length must be used specifically with caution, as it is somewhat variable. The cell $R_5$ is usually short and triangular, but in a large group of species elongate, by reason of the radio-medial cross-vein (r–m) being inserted on media (M) close to the medio-cubital cross-vein (m–cu), (compare figures 5, 19 and 20, with 6 to 10). In one or two species in this group the position of r–m, while always close to m–cu, varies from apicad to basad thereof, while in others it is more stable. In a few species the radial cross-vein is apicad of $R_5$, and therefore the cell $R_5$ is "petiolate" and very small (figures 19 and 20). Other features of the wings will be apparent from the illustrations.

The armament of the legs is of importance for specific differentiation. The tibiae and tarsi are closely pubescent. In some species the anterior metatarsi are armed with a row of three or four spines on the posterior border and two on the inner surface,

the outer surface of the middle tibae with a group of spines, and the posterior border of the hind tibiae with a row of a few spines, or any or all of these may be wanting. The claws are simple and slender.

The length of the first abdominal segment, whether it is constricted from or dorsally sessile with the second, whether it has an anterior narrow portion or neck, or whether it is enlarged directly from the base, are all matters of great importance in the differentiation of species. Sometimes it forms a long petiole, varying from slightly to strongly nodose, while again it may be short and not at all petioliform. Its sides are either coarsely punctured, or simply roughened by the insertion of numerous upright hairs. In giving measurements of this segment I have taken its length along the ridge or carina at its side, and its greatest dorsoventral thickness as seen from a strictly lateral view. The second ventral segment is usually more or less evenly convex, but in one species is truncate basally, with the truncate portion separated by an undulating, transverse carina. In a few species there is a short, median, basal, longitudinal keel on this segment. The setae of the second to sixth abdominal segments inclusive are almost invariably grouped into a sinuous or V-shaped closely-set row on each segment, as a rule about two-thirds of the way from the base to the apex, arising from well marked small punctures, while there are only very few scattered over the rest of the surface. In one or two species, as notably *stygia*, these rows become indistinct, or at places altogether lost in a mass of setigerous punctures scattered over the abdomen. The pygidium is narrow and notched, truncate or obtuse at tip, with or without lateral margins, sometimes with a raised, median, longitudinal, impunctate, polished strip, and with a varying number of coarse, setigerous, lateral punctures.

I am not certain of the homologies of some of the parts of the genitalia and use the terminology only tentatively, endeavoring to make it correspond with that used by Dr. Franklin for the Bombidae.[3] The uncus is an unpaired median organ, varying greatly in shape in the different species, sometimes with a V-

[3]Franklin, Henry J. The Bombidae of the New World. Transactions of the American Entomological Society. 1912. 38: 177–486. 1913. 39: 73–200. 22 pl.

shaped or square notch at tip (figures 36 and 47), and in one species (*crassa*) with the entire apical portion bent sharply upwards and bifid (figures 21 and 22, A). The sagittae are in the mass of species blade-like, slender, and nearly as long as the uncus (figures 39, 40, and 43 to 49, C), but in those of the *castanea* group are short and of various forms (figures 21 to 30, C), in one case (*stygia*) with their apices much thickened, tricuspid and truncate (figure 25, C). What I suppose represent the volsellae are always reduced to a pair of small chitinous buttons at the base of and just exterior to the sagittae (figures 21 to 31 and 40, D). The rami are roughly quadrate pieces (figure 21, E), bearing the long hirsute squamae (figure 21, B). Their upper posterior angle, as seen from the side, is sometimes acutely produced (figure 34), sometimes rounded and rolled inward or recessive (figure 48). A piece on either side attached both to the lower part of the ramus and the base of the sagitta within, I have termed the inner side of the ramus. It usually bears a brush of bristles. The squamae are long or short, pointed at tip, and sometimes with a distinctly differentiated posterior margin (compare figures 35 and 39), which in three species is deeply notched (figures 21, 24 and 27). This notch is usually apparent externally without dissection.

The genitalia of the Mutillidae are of a very different type from those of *Brachycistis*, especially as concerns the uncus, which in the former, if I am correct in my correlation of parts, is a paired organ, the penis-zapfen of Zander or crochets of Radoszkowski. The probable correspondence of the terms used by the latter author for Mutillidae,[4] with those used in this paper for *Brachycistis* are indicated in the explanation of the plates on page 289.

Type of the genus: *Brachycistis petiolatus* Fox, by designation of Ashmead, 1903.

### A Key to the Subgenera of Brachycistis

Forewings with three submarginal and three discoidal cells (figure 5), or in one species with two submarginal and two discoidal cells (figure 20).
**Brachycistis** Fox

Forewings with only one submarginal and two discoidal cells (figure 50).
**Brachycistellus** Baker

[4]Revision des armures copulatrices des mâles de la famille de Mutillides. Par le Général Radoszkowski. Horae Societas entomologica Rossicae. 1885. 19: 3–44. pl. I–IX.

Subgenus **Brachycistis** Fox

## A Key to the Species of the Subgenus Brachycistis known to occur in America north of Mexico

### *Males*

1. Fore-wing with cell $R_4$ enclosed, therefore 3 submarginals present (figures 9 and 20). ..... (4)
   Fore-wings with $R_4$ not enclosed, therefore only two submarginals present (figure 5). ..... (2)

2. Occiput not separated from the vertex by a carina; ocelli small, the diameter of the posterior pair equal to one-third of their distance from the compound eyes; cell 2d $R_1 + R_2$ very small, linear, ending before the apex of the stigma (figure 20)..... **perpunctata** Cockerell
   Occiput separated from the vertex by a carina; ocelli large, the diameter of the posterior pair equal to their distance from the compound eyes; cell 2d $R_1 + R_2$ small but not linear, ending at or slightly beyond the apex of the stigma (figure 9)..... (3)

3. Lateral angles of the propodeum rounded, not prominent, evenly, not rugosely punctured; r–m inserted closely apicad of m–cu, or sometimes opposite or even basad thereof (figure 9)..... **eremi** new species
   Lateral angles of the propodeum prominent, somewhat angular, rugose, in part reticulate; r–m usually inserted about midway between m–cu and $M_{3+4}$, sometimes nearer the latter, and sometimes nearer the former, but rarely close to m–cu and never opposite or basad thereof.
   **brevis** Fox

4. Front wing with r–m inserted on M close to m–cu, the cell $R_5$ therefore elongate (figures 7 and 10); abdomen sessile..... (5)
   Front wing with r–m inserted on M close to $M_{3+4}$, the cell $R_5$ short and triangular (figure 5)..... (8)

5. Posterior margin of the squama deeply notched, so that it is somewhat biramose (figure 24)..... (6)
   Posterior margin of the squama entire (figure 31).
   **thermarum** new species

6. Coal black, with white pubescence; the diameter of the posterior ocelli approximately equal to one-half of their distance from the compound eyes ..... **stygia** new species
   Castaneous; the diameter of the posterior ocelli equal to their distance from the compound eyes..... (7)

7. Second ventral segment without a transverse ridge; pygidium bounded by sharp lateral carinae and with a raised median longitudinal fold, the interstices considerably depressed; lower margin of the antennal socket simple; squama acute; uncus neither recurved not bifid (figure 27).
   **castanea** (Cresson)

Second ventral segment near its base with a well-defined undulating transverse ridge; pygidium with its lateral margins poorly defined, the median area very indefinitely raised; lower margin of each antennal socket armed with a tubercle projecting ventrad; squama obtuse; apical portion of uncus bent backwards and notched at apex (figures 21 and 22).

**crassa** new species

8. Propodeum with a strong transverse carina separating the dorsal from the caudal surface. ..... (9)

Propodeum without a transverse carina..... (12)

9. Distance from the apex of the cell 2d $R_1 + R_2$ to the apex of the stigma .7 the length of the stigma or more (figure 11)..... (10)

Distance from the apex of the cell 2d $R_1 + R_2$ to the apex of the stigma .3 the length of the stigma (figure 5); greatest dorso-ventral thickness of the petiole .4 of its length; second ventral segment simple.

**carinata** Fox

10. Petiole with a long slender anterior neck, but little swollen toward the apex, its length three times its greatest dorso-ventral thickness; second ventral segment with a mere trace of a longitudinal carina at its base.

**idiotes** Cockerell

First abdominal segment short, thick, not anteriorly produced into a neck, half as long again as its greatest dorso-ventral thickness; second ventral segment with a sharp longitudinal carina at its base..... (11)

11. Clypeus evenly rounded, the margin elevated; mesopleura each with a poorly marked rugosity, but not as in the following species; the distance from the end of the stigma to the apex of the marginal cell .8 the length of the stigma..... **aequalis** Fox

Clypeus with its median portion produced and truncate, not elevated; mesopleura each with a large impressed basin, surrounded by rugae and posteriorly by a carina; the distance from the end of the stigma to the apex of the marginal cell equal to the length of the stigma (figure 11).

**noctivaga** new species

12. Cell $R_5$ minute and far remote from the base of the cell 2d $R_1+R_2$; the vein $R_4$ but slightly apicad of the radial cross-vein, far basad of the apex of the cell 2d $R_1+R_2$. Small species, 6 to 8 mm. in length; middle of clypeus with a tubercle (except possibly in *gaudii*)..... (13)

Cell $R_5$ larger, triangular and reaching to or nearly to the base of 2d $R_1 + R_2$; the vein $R_4$ far apicad of the radial cross-vein..... (16)

13. Propodeum rugose or smooth, not lineolate; color never black..... (14)

Propodeum transversely minutely lineolate. Color black.

**gaudii** Cockerell

14. Propodeum without sculpture, other than a median basal groove, its lateral angles rounded; thorax honey yellow, head and abdomen darker. Length, 6 mm. (New Mexico)..... (15)

Propodeum with the sides of the dorsal surface and the postero-lateral angles rugose; mandible with three teeth, a strong carina reaching the inner tooth; rather uniformly dark castaneous. Length, 8 mm. (Lower California). ..... **petiolata** Fox

15. Transverse diameter of posterior ocelli about one-third greater than their distance from the eyes. . . . . **elegantula** Cockerell and Casad
Transverse diameter of the posterior ocelli equal to their distance from the eyes. . . . . **indiscreta** Fox

16. First abdominal segment petiolate, long and slender, the anterior linear portion longer than the slightly swollen posterior portion; propodeum abnormally long and low, without sculpture and without boundary between its dorsal, posterior, and lateral faces. Large and slender species. . . . . (17)
First abdominal segment petiolate or sessile, but comparatively short, the anterior narrowed portion always shorter than the strongly swollen posterior part, often very short. Species usually smaller and more robust. . . . . (18)

17. Head .4 wider than minimum distance between the tegulae; petiole, viewed from the side, evenly and but slightly enlarged posteriorly, four times as long as its greatest dorso-ventral thickness; mandible without a carina on the upper surface at base; $R_s$ not meeting r–m at an angle, the cell $R_5$ therefore triangular; color dark castaneous. Length, 20 mm. **protracta** new species
Head one-tenth wider than minimum distance between the tegulae; petiole suddenly widened toward its apex, three and one-half times as long (measured along the side) as its greatest dorso-ventral thickness; each mandible with a strong carina along its upper surface arched into a tooth near its base; $R_s$ meeting r–m at an angle, the cell $R_5$ therefore four-sided; color brownish yellow. Length, 14 mm. . . . . **ampla** (Blake)

18. Posterior tibia with a row of from two to five stout spines along the posterior edge; middle tibia with a group of stout subapical spines on the outer surface. Length, 14 mm. . . . . (19)
Posterior tibia unarmed; middle tibia with spines fewer and inconspicuous or wanting. . . . . (21)

19. Diameter of the posterior ocelli one-third greater than their distance from the eyes; longer posterior tarsal spur two-thirds as long as the metatarsus. Color castaneous, head a little darker. . . . . **alcanor** (Blake)
Diameter of the posterior ocelli not exceeding their distance from the compound eyes; longer posterior tarsal spur one-half as long as the metatarsus. . . . . (20)

20. Head black; sagittae slender and pointed. . . **ioachinensis** new species
Head concolorous; sagittae thick and blunt. . . . . **nitida** (Cresson)

21. Basal abdominal segment dorsally not at all constricted from the second, laterally scarcely or not at all so, short, thickened, and without anterior neck; color brownish orange or castaneous with the head darker or black. (22)
Basal abdominal segment strongly constricted dorsally and laterally from the second, short or long, with or without an anterior neck; size and color various. . . . . (23)

22. Anterior metatarsus with a row of three erect spines on the posterior border, and two smaller ones on the inner surface; diameter of the posterior ocelli 1.8 times as great as their distance from the eyes. Length, 12 mm. . . . . **eriopis** new species

Anterior metarsus without erect spines along the edge, two small ones on the posterior surface; diameter of the posterior ocelli 1.2 times as great as their distance from the eyes; sagittae short, thick and blunt (figures 41 and 42). Length, 8 mm. . . . . **arenivaga** new species

23. Ocelli small and not prominent, the transverse diameter of the hind pair scarcely more than equal to one-half their distance from the eyes, and approximately equal to their distance from the front ocellus; carina of the mandible with an angular elevation at base. Color black. Length, 8 mm., slender. . . . . **micrommata** new species

Ocelli larger, prominent, sometimes very large, the transverse diameter of the posterior pair but little less than their distance from the eyes, usually equal to or greater than the same, and equal to at least twice their distance from the anterior ocellus. . . . . (24)

24. Head and body black, or, if the thorax is red or reddish, at least the legs are fuscous; stigma black; petiole longer, with its neck longer and more slender than in the following. . . . . (25)

Color brownish orange to castaneous. The abdomen and thorax are both always castaneous or yellowish, and if the head is black the legs are testaceous or reddish, not fuscous; stigma sometimes brown, more often yellow; petiole with a short neck or none at all. . . . . (26)

25. Small slender species, entirely black. Length, 8 mm. . . . . **atrata** (Blake)

Larger species, less slender, usually with more or less dark red on the thorax, sometimes entirely black. Length, 10 mm. . . . . **nuda** Fox

26. Width of the petiole at its apex equal to its lateral length, its thickness from two-thirds to three-fourths thereof. . . . . (29)

Width of the petiole at its apex from .6 to .8 of its lateral length, its thickness from one-half to three-fifths thereof. . . . . (27)

27. Ocelli small, the transverse diameter of the posterior pair less than their distance from the eyes. . . . . (28)

Ocelli large, their transverse diameter nearly one-half again as great as their distance from the eyes; color brownish orange. Length, 10 mm.; stout. . . . . **nevadensis** Fox

28. Carina on the mandible not reaching more than half way to the base; width of the petiole .8 of its lateral length, its thickness .6 thereof; color brownish orange. Length, 10 mm. . . . . **subquadrata** Fox

Carina on the mandible reaching the base where it is strongly and angularly elevated; width of the petiole .6 of its lateral length, its thickness less than .5 thereof; reddish castaneous; head black. Length, 8 mm., slender. . . . . **dentata** new species

29. Edge of the clypeus preceded by a transverse lamina or tubercle. . . . . (30)

Margin of the clypeus emarginate, not thickened, but the apical portion of the clypeus prominent, without a transverse lamina or tubercle; entirely brownish orange, stigma concolorous. . . . . **inaequalis** Fox

30. Head black; tubercle on the clypeus strongly transverse.
**glabrella** Cresson

Head concolorous; tubercle on the clypeus less transverse and more elevated..... **triangularis** Fox

*Females*

Front with a strong median biramose prominence above the base of the antennae; dark castaneous. Length, 6 mm..... **B. rutilans** (Blake)

Front with a moderate process on either side, immediately above the base of each antennae, the two not confluent; testaceous. Length, 4 mm.
**B. bimaculata** Fox

**Brachycistis** (**Brachycistis**) **atrata** (Blake), ♂.

1899. *Brachycistis contiguus* Fox, Trans. Amer. Ent. Soc., 25:282, ♂.

This species is very closely allied to the following, indeed doubtfully distinct from it. The abdomen of the type of *atrata* has been replaced by an abdomen belonging to a male *Mutilla*, that has furnished the characters by which Fox distinguishes the species in his key.

Nevada: [*Types* of *atrata* and of *contiguus*, American Entomological Society]. California: Claremont, 1♂, (C. F. Baker), [Cornell University].

**Brachycistis** (**Brachycistis**) **nuda** Fox, ♂.

1899. *Brachycistis nigritus* Fox, Trans. Amer. Ent. Soc., 25:282, ♂.

*Genitalia:* Sagitta long, narrow, and acute; volsella reduced to a small scale; ramus without prominent angles; squama long and slender, with entire margin; uncus as seen from the side arched and somewhat thickened medially, from above strongly widened toward the apex, which is acutely notched.

The absence of pubescence described as characterising this species, and from which it takes its name, is due to artificial denudation. The genitalia are described from a specimen from Claremont, California.

California: [*Type* of *nudus*, American Entomological Society]; Claremont, 2♂, (C. F. Baker), [Pomona College and Cornell University]; Laguna Beach, 1♂, (C. F. Baker), [Pomona College]. Washington: [*Type* of *nigritus*, American Entomological Society]. Nevada: [*Type* of *nigritus*, American Entomological Society].

**Brachycistis** (**Brachycistis**) **dentata** new species

♂. Head black; thorax strongly reddish castaneous; abdomen castaneous; legs testaceous, the posterior femora brown; antennae brownish orange; sparsely yellowish pubescent; wings hyaline, the stigma fuscous brown, the veins pale to dark fuscous. Length, 8 mm.

Head polished, with very few small punctures; ocelli moderately large and prominent, with a transverse impressed line behind but none between them; their measurements:[5] .21 mm., .26 mm., .36 mm.; front slightly convex, with even surface, neither tuberculate nor carinate; inferior margin of each antennal socket somewhat thickened, but without a tubercle; clypeus raised to a sharp, median, apical point, the apex rather narrowly emarginate, with distinct but not sharp lateral angles; mandible with large teeth, a strong carina extending basad from the inner one, strongly angularly elevated just before the base of the mandible; gular orifice wide, its lateral margins strongly produced and reflexed, distant from the eyes by about the length of the last segment of the labial palpus or a little less, and by distinctly less than the diameter of the swelling at the base of the mandibles. Antennae not crenulate.

Humeral angles not evident; pronotum medially rugulose, laterally sparsely punctured, almost impunctate on the lower part; mesonotum anteriorly with more than the usual number of small setigerous punctures, posteriorly almost impunctate, polished; scutellum polished, with few dorsal punctures and numerous minute lateral punctulations; post-scutellum with three or four dorsal punctures and a few lateral punctulations; mesopleura polished, with scattered punctures, which become obsolete ventrally and posteriorly, the surface strongly convex but not irregular, with a pit near the posterior margin; propodeum dorsally neither sculptured nor polished, without a transverse apical carina, the hind angles rounded, not prominent, the posterior face strongly declivous, roughened by the insertion of numerous hairs, as are also the upper parts of the sides.

Wings as shown in figure 18.

The anterior metatarsi and the middle and posterior tibiae are without the noticeable spines found in some species.

Petiole rather strongly nodose, constricted from the second segment, moderately long, with a distinct anterior neck, its sides roughened by the insertion of numerous erect hairs; pygidium notched, immargined, with a few poorly defined lateral punctures.

Sagitta slender, and tapered, its apex bent upward; volsella reduced to a scarcely noticeable button; superior hind angles of the ramus rounded, receding; inner side of the ramus with a brush of setae; squama rather short and thick; uncus as seen from the side widening to the apex, from above strongly compressed, without a flaring apical portion, the apex not notched (figure 45).

*Type*.—Jemez Springs, New Mexico, May 29, 1913, (Mr. John Woodgate), [Cornell University, No. 117.1].

**Brachycistis (Brachycistis) triangularis** Fox, ♂.

*Genitalia:* Sagitta long, slender and blade-like, ending a little before the tip of the uncus; volsella reduced to small chitinized button; squama rather stout, its posterior margin entire; uncus slender, slightly widened before and notched at the tip, somewhat decurved (figures 46 and 47).

[5]Given always in the following order: narrower diameter of the posterior ocelli, their distance from the compound eyes, their distance from each other.

Description and figures drawn from a paratype in the collection of the American Entomological Society.

Arizona: [*Type*, American Entomological Society].

**Brachycistis glabrella** (Cresson), ♂.

*Brachycistis alcanor* (Blake) is not a synonym of this species, as has been previously supposed.

Colorado: [*Type*, American Entomological Society, No. 1893].

**Brachycistis subquadrata** Fox, ♂.

California: [*Type*, American Entomological Society].

**Brachycistis** (**Brachycistis**) **micrommata** new species

♂. Black, the tarsi and antennae brown, the latter dark except at base; sparsely clothed with somewhat yellowish pile; wings hyaline, slightly infuscated beyond the stigma, which is piceous; veins brownish yellow to piceous. Length, 8 mm., slender.

Head polished, with few small punctures; ocelli small, not prominent and widely separated, the portion of the vertex on which they are situated not strongly elevated, as is usual, a weak transverse depression behind and a longitudinal one between them; measurements: .17 mm., .3 mm., .38 mm.; forehead with even, slightly convex surface, neither ridged nor tuberculate; inferior margin of each antennal socket thickened, with a downward projecting triangular tubercle; clypeus polished, somewhat depressed, with a raised median marginal point, the apex emarginate with a tooth on either side; apex of mandibles wide, the two inner teeth of equal size, rather large, a strong carina extending from the inner to the condyle, just before which it is strongly but not angularly elevated; antennae slightly crenulate at apex.

Humeral angles not evident, entirely rounded; pronotum with sparse small punctures; mesonotum polished, with very few small punctures, the lateral grooves well marked; scutellum convex, its disc polished, with very few small punctures, its sides with a few minute punctulations; disc of post-scutellum polished, with one or two punctures, the sides without the usual punctulation; mesopleura strongly convex, the surface uniform, with scattered rather coarse punctures, the lower posterior part entirely impunctate and shining; propodeum with a weak median depression, the dorsal surface otherwise impunctate, without a transverse apical carina, the lateral angles rounded, the posterior face strongly declivous, roughened by the insertion of numerous erect hairs as are also the superior parts of the lateral faces.

Wings as shown in figure 15.

Anterior metatarsus without spines; middle tibia without a group of spines on its outer surface, one or two present but so reduced as to be hidden and entirely inconspicuous; posterior tibia unarmed.

Petiole strongly nodose, with a short but distinct anterior neck, dorsally constricted from the second segment, laterally roughened by the insertion of upright hairs; pygidium obtuse, with two or three coarse basal punctures on each side, a weak median elevation and weakly margined laterally.

*Type.*—Berkeley, California, June 30, 1898, [Cornell University, No. 118.1].

**Brachycistis (Brachycistis) nevadensis** Fox, ♂.

*Genitalia:* Sagitta long, slender, blade-like and curved; volsella an inconspicuous scale; squama with an entire apical margin; uncus from a dorsal view slightly and gradually thickened toward the apex, bearing a wide apical notch, from a lateral view rather strongly thickened before the apex and decurved (figure 43).

Described and figured from the type specimen.

Nevada: [*Type*, American Entomological Society].

**Brachycistis (Brachycistis) inaequalis** Fox, ♂.

*Genitalia:* Sagitta long, slender, blade-like, curved, ending very little before the tip of the uncus; volsella reduced to a minute scale; squama rather slender, its lateral margin merging gradually into the posterior, which is not notched; uncus from a dorsal view slightly widened toward the tip, which bears a wide and deep semicircular notch, from a lateral view rather strongly thickened before the apex, decurved (figure 49)..

Description and figure drawn from a paratype in the collection of the American Entomological Society.

California: Los Angeles, September, [*Type*, United States National Museum, *paratypes*, American Entomological Society].

**Brachycistis (Brachycistis) eriopis** new species

♂. Mahogany red, the head much darker, the antennae and legs yellow; clothed with sparse, erect, yellowish pubescence; wings hyaline, faintly clouded toward the apex; veins yellow to brown, Sc + R + M dark brown, the stigma golden yellow. Length, 12 mm., stout.

Head with few minute punctures; ocelli very large and prominent, a transverse rugosity behind them, a deep transverse impressed line immediately behind and a longitudinal one between them, measurements: .38 mm., .28 mm., .5 mm.; four inconspicuous raised points above the base of the antennae, the lateral ones transverse; inferior border of each antennal socket inferiorly incrassate; clypeus slightly convex, shallowly emarginate, the edge not thickened; mandible with inner two teeth equal, short and blunt, an elevated curved carina extending half-way to the base; gular orifice narrow, its barely margined edge distant from the eye by considerably more than the length of the last segment of the labial palpi, and from the swelling at the condyle of the mandibles by about twice the thickness of the same. Antenna crenulate; basal segment of the flagellum somewhat curved, a little more than twice as long (.68 mm.) as thick (.28 mm.).

Humeral angles entirely rounded, indistinct; pronotum with only sparse and small setigerous punctures; mesonotum polished, bearing minute irregularly scattered punctures and distinct lateral grooves, deeply depressed in front of the scutellum; the latter convex, with a few small punctures; postscutellum

medially convex and impunctate, laterally with some minute punctulations; mesopleura swollen, but not irregularly, the surface polished, with sparse small punctures, a pit anterior to the upper posterior edge; dorsal face of the propodeum polished, impunctate, without sculpture, not separated from the posterior by a carina, lateral angles prominent but entirely rounded, lateral face, except above, polished and impunctate, its upper parts and posterior face roughened by the insertion of numerous hairs.

Wings as shown in figure 14. The spur extending basad from m–cu is undoubtedly abnormal.

Anterior metatarsus with four slender spines along the posterior inner margin and two on the outer; middle tibia with a small group of inconspicuous spines on the apical part of the outer surface; posterior tibia without spines on the hind margin.

Abdomen sessile, the first segment short, thick, and enlarging directly from the base, without anterior neck; its sides with the basal and lateral parts of the dorsal surface roughened by the insertion of numerous hairs, the rest of the abdomen polished, with only small setigerous punctures, more or less gathered into transverse rows; the second ventral segment not carinate.

*Type*.—Calexico, Imperial County, California, August 11, 1914, (the author), [Cornell University, No. 119.1].

This species is closely allied to *nitida* and *ioachinensis*.

**Brachycistis (Brachycistis) nitida** (Cresson), ♂.

*Genitalia:* Sagitta strongly compressed, blade-like, but of considerable width dorso-ventrally, obtuse, of moderate length, and with the apical portion somewhat deflexed; the volsella forms a comparatively large chitinous button; upper posterior angle of the ramus bluntly rectangular, its inner surface with a patch of erect, stiff bristles; squama rather short and broad, its tip mucronate; uncus as seen from the side strongly arched, narrowed in the middle and much widened before the apex, from above it appears long and slender, the apical third widened, and the apex with a deep, almost rectilateral notch.

The description of the genitalia is drawn from a specimen from Arizona in the collection of Cornell University.

Colorado: [*Type*, American Entomological Society No. 1892]. New Mexico: [American Entomological Society]. Arizona: Nogales, July 10, 1903, 1 ♂, (E. J. Osler), [Cornell University].

**Brachycistis alcanor** (Blake), ♂.

This species has been incorrectly considered a synonym of *glabrella*.

Arizona: [*Type*, American Entomological Society].

**Brachycistis (Brachycistis) ioachinensis** new species

♂. Brownish orange, the head black, the antennae and legs yellowish; clothed with sparse yellowish hairs; wings hyaline, the veins yellow to brown; Sc + R + M and the stigma dark brown. Length, 12 to 14 mm.

Head shining, with a few small punctures; ocelli very large and prominent, without a transverse impression behind and only a faint longitudinal impression between them, measurements: .4 mm., .25 mm., .53 mm.; forehead with a row of four small tubercles above the antennae, the two inner sharp and tooth-like, the two outer slightly transversely elongated; inferior margin of the antennal sockets with a downward projecting thickened fold; edge of the clypeus emarginate, thickened, and sloping; the surface above it strongly elevated; mandible with the inner two teeth of equal size, a strong curved carina extending from the innermost about half way to the base; gular orifice broad, its slightly reflexed lateral margin distant from the eye by about the length of the last segment of the labial palpi, and from the swelling at the base of the mandibles by considerably less than the thickness of the same; antennae not or scarcely crenulate.

Humeral angles rounded and indistinct; pronotum dorsally sparsely punctured, still more sparsely on the sides; mesonotum polished, shining, bearing very sparse small punctures and distinct lateral grooves which are rather deeply depressed in front of the scutellum; the latter convex, its disc with sparse punctures, its sides with minute punctulation; postscutellum subtuberculate, medially impunctate, laterally bearing small punctures and some minute punctulation; mesopleura swollen but not irregularly nor rugosely so, sparsely punctured, the punctures smaller and much sparser posteriorly and on the sternum; each mesopleurum bears a small pit anterior to the upper part of the posterior border; dorsal surface of the propodeum polished, impunctate, and without sculpture, not separated by a carina from the strongly declivous posterior face; the lateral faces, except above, polished and impunctate, the posterior and upper part of the lateral faces roughened by reason of bearing erect hairs.

Wing venation as shown in figure 13.

Anterior metatarsus with two short spines on its inner surface; middle tibia with a group of stout subapical spines on its outer surface; posterior tibia with a row of about four stout spines on its posterior margin.

First abdominal segment moderately short, not much thickened posteriorly, with a distinct but short anterior neck, its sides considerably roughened by the insertion of numerous hairs; second ventral segment without carinae; surface of abdomen polished and with only minute setigerous punctures; pygidium narrowed and truncate posteriorly, with indistinctly margined sides, a slightly raised, median, smooth fold, and a few coarse lateral punctures.

Sagitta long, slender, tapered and turned upward toward the apex; volsella reduced to a very small chitinous button; ramus with its posterior upper angles not produced, turned inward; the inner surface of the ramus with a brush of hairs; squama rather slender, bluntly tapering, without a differentiated or notched posterior border; uncus as seen from the side arched downward, from above strongly compressed, flaring into an oval head at apex, the tip deeply and squarely notched.

*Type material.*—Holotype: Coalinga, Fresno County, California, below 500 ft. elevation, June 1–3, 1907, (the author),

[Cornell University, No. 120.1]. Three paratopotypes, same date. Two paratypes from the Jacintas Barranca in the Kettleman Plains, Fresno County, California, June 4, 1907. As this locality is within a few miles of Coalinga the two latter are also to all purposes paratopotypes. [Cornell University, Nos. 120.2 to 120.6.]

The description of the genitalia is from a paratype.

This species finds its closest relatives in *nitidus* and *eriopis*, from which it is differentiated by the characters given in the key.

**Brachycistis (Brachycistis) arenivaga** new species

♂. Brownish orange; legs and antennae yellow; head reddish black; clothed with sparse, erect, yellow pubescence; wings hyaline; Sc + R + M brown, the other veins translucent yellow, the stigma golden yellow. Length, 8 mm.

Head with few minute punctures; ocelli large, prominent, a faint impressed line behind them, obsolete medially, and a faint longitudinal impression between them; measurements: .25 mm., .21 mm., .38 mm.; front medially prominent above the antennae, but without tubercles, except two vague lateral ones; lower rim of each antennal socket simple; clypeus slightly elevated medially, its surface nearly glabrous, polished, the edge emarginate medially, not thickened; mandible with its middle tooth smaller than the inner and more or less fused with it, the carina prominent, extending half way to the base; gular orifice small, its sides scarcely margined, removed from the eyes by more than the length of the last segment of the labial palpus, and from the swelling at the condyle of the mandible by about one and one-half times the thickness of the same.

Humeral angles wanting; pronotum sparsely and minutely punctured, laterally almost impunctate; mesonotum polished, with few minute punctures, depressed in front of the scutellum, the lateral grooves well marked; scutellum convex, its disc almost impunctate and polished, its sides with numerous smaller punctures; postscutellum impunctate, its sides without the usual minute punctulation; mesopleura with the surface regular, polished, almost impunctate, the punctures being very few, small, and shallow; each mesopleurum bears a pit in front of its posterior margin; propodeum polished, impunctate above, with a faint median impressed line, the hind surface steeply declivous, beset with hairs, not separated from the dorsal surface, the posterior lateral angles rounded, not prominent, the sides polished, impunctate.

Wing venation as shown in figure 16.

Anterior metatarsus without a row of spines, although there are two inconspicuous spines on its inner surface; middle tibia with a few feeble spines on the apical part of its outer surface, largely concealed; posterior tibia without spines.

First abdominal segment short, dorsally entirely sessile with the second, enlarged directly from the base, without an anterior neck, its surface polished

like that of the rest of the abdomen, with only sparse, minute, setigerous punctures; pygidium tapered, slightly notched at apex, its sides margined so far ventrad as to appear immargined from a dorsal view; polished, with uniform surface and almost impunctate.

Sagitta blade-like but short, thick, and blunt; volsella reduced to a basal disc; ramus oblique, its posterior margin sinuate, the upper posterior angle not produced, rolled broadly inward; a brush of hairs on the inner side; squama without notched posterior margin; uncus as seen from the side strongly curved, long, somewhat widened toward the obtuse tip; as seen from above, it is strongly compressed, flaring at apex, the extreme apex slightly notched (figures 41 and 42).

*Type material.*—Holotype: Calexico, Imperial County, California, August 11, 1914, (the author), [Cornell University, No 121.1]. Two paratopotypes, same date, [Cornell University, Nos. 121.2 and 121.3].

From *B. eriopis*, which is perhaps its closest ally, *arenivaga* may be known by its smaller size, and by having only two small spines on the anterior metatarsus, instead of five preapical spines in two rows. The short sagittae distinguish the species from all the others in its group whose genitalia have been examined.

**Brachycistis (Brachycistis) ampla** (Blake), ♂.

Colorado: [*Types*, American Entomological Society]; Fox gives also, Custer, (T. D. A. Cockerell).

**Brachycistis (Brachycistis) protracta** new species.

♂. Castaneous, the base of the abdomen a little lighter, the legs shading into yellow, the antennae yellowish brown; clothed with sparse, rather long, nearly white pubescence; wings hyaline; the veins of various shades of brown; Sc + R + M and the stigma dark brown. Length, 20 mm.

Head .43 wider (width 2.66 mm.) than the least distance between the tegulae (1.85 mm.); head polished, shining, with a very few minute punctures; ocelli large, prominent, a weak impressed line behind but none between them; their measurements: .43 mm., .25 mm., .6 mm.; forehead above the base of the antennae with four raised points, the inner two inconspicuous; the lower margin of each antennal socket thin, without a downward projecting tubercle; clypeus nearly flat, its margin forming a depressed crescent, at the middle of the base of which is a wholly inconspicuous tubercle; mandible with its inner tooth somewhat smaller than the intermediate, the carina straight and extending only half way to the base; gular orifice small, its lateral margin elevated into a thin, angularly prominent carina, distant from the eye by about the length of the last segment of the labial palpus, and from the swelling at the condyle of the mandible by nearly twice the thickness of the same. Antenna long and slender, crenulate toward its apex, the basal segment of the flagellum .15 mm. thick and 1.28 mm. long, seven and one-half times the length of the pedicel.

Humeral angles wanting; pronotum polished, shining, with very sparsely and irregularly scattered minute punctures; mesonotum similarly sculptured, deeply impressed just in front of the scutellum; lateral lines distinct; disc of the scutellum with a few punctures, polished, shining, its sides, as also those of the postscutellum, closely and minutely punctulate; disc of postscutellum without punctures; mesopleura obliquely elongate, not strongly swollen and without appreciable rugosity, a small pit at quite a distance cephalad of the upper part of the posterior border, the surface polished, shining, with very sparsely but rather regularly scattered minute punctures; propodeum low and very elongate, with no appreciable posterior face, its surface smooth, polished, impunctate and without sculpture except for the few minute punctures from which hairs arise caudally and laterally.

Stigma long, rather narrow, cell 2d $R_1 + R_2$ extending beyond the apex of the stigma by about the width of the same; cell $R_4$ large, about as long as high; $R_5$ opposite the radial cross-vein; r–m inserted on M slightly nearer to M 3 + 4 than to m–cu.

Anterior metatarsus with a few spines on its inner surface; middle tibia with very strong spines on the apical half of its outer surface, the stoutest being on the posterior edge; posterior tibia with five or six stout spines on its margin.

Abdomen long petiolate, the first segment as viewed from the side, evenly and but slightly enlarged posteriorly, four times as long (3. 2 mm.) as its greatest dorso-ventral thickness (.8 mm.); viewed from above it is more appreciably thickened, with a median longitudinal depression just before the apex; abdomen polished, shining, with only sparse and very small setigerous punctures; pygidium flat, obtusely truncate, with ill-defined margins, and a few coarse punctures on its sides.

Sagitta long and slender, acute, reaching nearly to the tip of the uncus; volsella reduced to a small chitinized button; ramus short but very broad, its superior hind angle not at all produced, entirely rounded and turned inward, a brush of stout bristles on the inner surface; squama slender, acute, posterior margin not differentiated from the inferior, and not notched; uncus slender, as seen from above compressed, widened at the apex, but with a thin flaring inferior margin, stopping abruptly short of the base, the apex deeply notched.

*Type*.—Phoenix, Arizona. [American Entomological Society.]

This is the largest known species of *Brachycistis*.

It finds its nearest relative in *amplus* Cresson, the two being distinguished from all others by their long slender petioles and by their long, low, and rounded propodea.

**Brachycistis (Brachycistis) gaudii** Cockerell, ♂.

1901. *Brachycistis gaudii* Cockerell, Can. Ent., 33: 340, ♂.

1903. *Brachycistis gaudii* Melander, Trans. Amer. Ent. Soc., 29: 329, ♂.

Illustration of forewing, pl. IV, fig. 64.

I have not seen a specimen of this species. Professor Cockerell writes me that the type is in the United States National Museum.

California: La Jolla, Aug. 1901, 3♂, at light, *types*.

**Brachycistis** (**Brachycistis**) **elegantula** Cockerell and Casad, ♂.

*Genitalia:* Sagitta long and slender, blade-like, subacute; volsella reduced to a small scale; ramus broad; squama long and slender, its apical margin entire; uncus long and slender, scarcely widened before and notched at the tip (figure 48).

Description and figure drawn from a specimen in the collection of the American Entomological Society, presumably from the type series.

New Mexico: Mesilla Park, September 22, 1894, many male types, (T. D. A. Cockerell).

**Brachycistis** (**Brachycistis**) **petiolata** Fox, ♂.

Lower California: Calmalli Mines, April, [*Type*, American Entomological Society].

**Brachycistis** (**Brachycistis**) **carinata** Fox, ♂.

*Genitalia:* Sagitta long, slender, blade-like, ending very slightly before the tip of the uncus; volsella a minute scale; squama slender, with an entire apical margin; uncus, from a dorsal view long and slender, strongly widened just before the tip, which is broadly notched, from the side swollen before and tapered at the apex (figure 44).

Described from a homotype from La Jolla, California.

California: [*Type*, American Entomological Society]; La Jolla, June 25, 1913, 1♂, (E. P. Van Duzee), [Cornell University]; San Diego County, June 28, 1913, 1♂, (E. P. Van Duzee), [Cornell University]; Claremont, 2♂, (C. F. Baker), [Pomona College and Cornell University]; Ramona, San Diego County, August 15, 1914, 1 ♂, (the author), [Cornell University].

**Brachycistis** (**Brachycistis**) **idiotes** Cockerell, ♂.

1903. *Brachycistis idotes* Melander, Trans. Amer. Ent. Soc., 29: 327, ♂. Forewing illustrated, pl. IV, fig. 62.

New Mexico: Las Cruces, *type* partly destroyed by Anthrenus, (T. D. A. Cockerell).

**Brachycistis** (**Brachycistis**) **aequalis** Fox, ♂.

Colorado. Nevada. Arizona. [*Type* series, American Entomological Society.]

**Brachycistis** (**Brachycistis**) **noctivaga** new species

♂. Brownish orange; legs and antennae yellow; clothed with a sparse, somewhat yellowish pubescence; wings hyaline; the veins and stigma yellow; Sc + R + M, except at apex, brown.

Head smooth, more or less polished, with only a few punctures; ocelli very large and prominent, with a transverse impression behind but no impression between them, their measurements: .38 mm., .23 mm., .45 mm.; an oblique carina on each side of the forehead, limiting an impressed basin above each antenna, the carinae originating close above the antennae, close to the eye, and converging upward; between these two basins the surface prominent and slightly rugose; inferior margin of each antennal socket not thickened, but with a slight tubercle below; margin of the clypeus prominent, medially with a broad process projecting downward, on either side of which the margin is deeply notched; mandible with the two inner teeth of equal size, unusually acute, the only remnant of a carina being a short tubercle at some distance from the inner tooth; gular orifice moderately broad, its margin produced into a tooth at the side, distant from the eyes by more than the length of the last segment of the labial palpus, from the swelling at the condyle of the mandibles by slightly more than the thickness of the same. Antennae somewhat crenulate toward their tips.

Humeral angles quite noticeable but not very prominent; sides of the pronotum coarsely and closely punctured, more sparsely below, the dorsal surface with only minute punctures except along the posterior margin; mesonotum coarsely but sparsely punctured, bearing strong lateral grooves; scutellum with a longitudinal impressed line and coarse punctures on the disc, its sides and the postscutellum closely and minutely punctulate; mesopleura with coarse but mostly sparse punctures, very irregularly and rugosely swollen, a large impressed basin on the most swollen part of each, bordered posteriorly by a curved carina and above by a marked rugosity; dorsal surface of the propodeum shagreened, with a broad parallel-sided, deep, median channel, traversed by four cross-bars; at its apex an equally broad and deep, sinuous, transverse channel, the posterior border of which is formed by a carina separating the dorsal from the almost vertical, flat, caudal surface; coarse punctures, becoming in places rugose, are borne on the upper part of the lateral and caudal faces.

Wing venation as shown in figure 11.

Inner surface of the anterior tibia with a transverse subapical row of three spines; inner surface of the anterior metatarsus with three prominent spines; outer surface of the middle tibia spinose, almost to the base, and with four coarse spines near the apex of the posterior edge; posterior tibia with five or six spines along the posterior edge.

First abdominal segment short, rather broad and thick, enlarging almost from the very base, with only a very short anterior neck; as seen from above noticeably constricted from the wide second segment; basal third of the second ventral segment with a strong raised longitudinal keel, ending in a sharp tooth posteriorly; first segment laterally, closely and coarsely punctured, dorsally with sparse punctures, remaining segments polished, with only sparse, minute, setigerous punctures; pygidium truncate, with weak lateral carinae, and coarse punctures toward the sides at base.

Sagitta blade-like, but short and blunt; produced externally along the middle; volsella a compressed disc; ramus nearly quadrangular, its posterior edge almost straight, its superior hind angle not at all produced; the inner surface with a brush of bristles; squama short and wide, its posterior margin entire; uncus as seen from the side straight and tapering bluntly to the apex, from above keeled in the middle, sloping steeply to the nearly parallel side, tip deeply but narrowly notched (figures 35, 36, and 37).

*Type material.*—Holotype: Las Vegas, Nevada, September 17, 1908, (the author), [Cornell University, No. 122.1]. Paratype: Nevada, [American Entomological Society].

This species is allied to both *aequalis* and *idiotes*, which have each an elongate marginal cell, and would possibly go along with *noctivaga* into Andre's genus *Milluta* if this genus were recognized, were it not for their simple tarsal claws. The sculpture of the mesopleura, forehead and propodeum abundantly distinguish *noctivaga* from any other.

**Brachycistis (Brachycistis) thermarum** new species

♂. Brownish orange; legs and antennae yellowish orange; clothed with sparse, slightly yellowish pubescence; the wings hyaline, with pale yellow veins and stigma. Length, 10 mm.

Head polished, shining, with punctures irregularly and sparsely scattered; ocelli large, moderately prominent, with a deep, impressed, transverse line behind them, but no longitudinal line between; measurements: .28 mm., 3 mm., .38 mm.; forehead above the base of the antennae with four tubercles; inferior margins of the antennal sockets somewhat incrassate, with a small tubercle projecting downwards; clypeus slightly raised to a median antemarginal point or small tubercle, from there sloping to the shallowly emarginate edge; mandible with its inner two teeth equal in size, acute, a carina extending from the inner toward but disappearing before the base of the mandible; gular orifice small, its edge removed from the eye by more than the length of the last segment of the labial palpus, and from the swelling at the base of the condyle of the mandible by more than twice the apparent width of the same. Antennae strongly crenulate, especially toward their apices.

Pronotum with prominent humeral angles, its surface coarsely and closely punctate, the punctures a little sparser on the lower part of the sides; mesonotum bearing coarse, only moderately sparse punctures, and distinct lateral grooves; scutellum with coarse and sparse punctures, its sides with a few closer punctures and some minute punctulations; postscutellum closely minutely punctulate, with also two or three coarse punctures; mesopleura coarsely punctured, the punctures confluent close to the superior border, becoming sparse as they approach the sternum, the surface prominent but only slightly irregularly swollen; dorsal face of the propodeum impunctate, with a median longitudinal impressed channel, separated from the posterior face by a transverse carina; the lateral angles prominent, with a few coarse punctures,

extended along the top of the lateral faces, which bear also a few small punctures above but none below; posterior face sharply declivous, with a few hairs arising from small punctures.

Wing venation as shown in figure 10.

Inner surface of the anterior metatarsus with a few erect but not stout spines; middle tibia with a group of stout spines on the apical part of its outer surface, two or three near the apex on the posterior margin being especially stout; posterior tibia with a few stout spines on its posterior border and on the apical part of its outer surface.

Abdomen sessile, the basal segment short, broad and rather thick, enlarging directly from the base, without anterior neck, separated by a shallow depression from the second ventral; the latter with convex horizontal surface only and no transverse carina; sides of the first segment coarsely and closely punctate, its dorsal surface and the rest of the abdomen polished, very sparsely and finely punctate; pygidium shallowly emarginate, its sides sharply margined, bearing a median, longitudinal, slightly raised, impunctate fold, the depressed areas between this and the margins with a few punctures.

Sagitta much reduced, slightly chitinized, each forming a thin-edged, rolled plate, somewhat as in *crassa;* volsella a small compressed disc; ramus broad, its apical margin broadly emarginate, the postero-dorsal angle forming a prominent bluntly pointed process, the inner surface with a sparse brush of setae; squama broad, its posterior margin not notched; uncus as seen from the side strongly falcate from beyond a prominent angle near the base, as seen from above, flattened, its apex obtusely truncate, not at all emarginate (figures 31, 32, and 33).

*Type.*—Hot Springs, Arizona, July 2, 1902, (E. J. Oslar), [Cornell University, No. 123.1].

This species finds its nearest relatives in *crassa*, *castanea* and *stygia*. The shape of the uncus is absolutely distinctive, as far as I have observed.

**Brachycistis (Brachycistis) castanea** (Cresson), ♂.

1865. *Mutilla castanea* Cresson, Proc. Ent. Soc. Phila., 4: 388, ♂.

*Genitalia:* Sagitta very short and blunt, each bearing externally toward its apex a pitted chitinous bulb, and overlapped by the ends of the short volsella, which is still smaller than the sagitta; ramus large, thick, its posterior margin deeply concave, its inner surface with an inconspicuous setiferous area; squama short and thick, its posterior margin deeply notched, its upper angle produced into an acute lobe; uncus straight, thick and blunt, greatly widened before and abruptly tapered to the apex (figures 27 and 30).

The description and figures of the genitalia are drawn from a balsam mount made from a homotype from Durango, Colorado.

Some of the specimens found standing in the collection of the American Entomological Society under this name, and so recorded by Fox, belong to other species.

Lower California: Cape St. Lucas, [*Type*, American Entomological Society, no. 1894]. New Mexico: Albuquerque, no date, 2 ♂, July 16, 1902, 1 ♂, (E. J. Oslar), [Cornell University]. Colorado: Durango, 1 ♂, (E. J. Oslar), [Cornell University].

**Brachycistis** (**Brachycistis**) **stygia** new species

♂. Entirely coal black, with white pubescence; wings hyaline, infuscated beyond the stigma, especially along the costal margin, becoming clearer again toward the margin. Length, 13.5 mm.

Head polished, shining, with sparse but not small punctures; ocelli smaller than usual, not very prominent, the posterior pair removed by twice their diameter from the eyes; measurements: .25 mm., .5 mm., .6 mm.; a faint, transverse impression behind the posterior pair, but no longitudinal impressed line between them; forehead above the antennae simple; inferior margin of each antennal socket thin, without a tubercle, closely short-hirsute; clypeus not tuberculate, thickly punctured toward the margin, which is thickened, emarginate, and slightly raised; mandible with the inner two teeth strong and blunt, of equal size, a falcate blunt carina extending from the inner one to the base; gular orifice small, its margin removed from the eye by considerably more than the length of the ultimate segment of the labial palpus, and from the globular swelling at the condyle of the mandible by considerably more than the apparent diameter of the same. Antennae strongly crenulate toward their apices.

Pronotum with prominent but rounded humeral angles, these and its dorsal surface closely coarsely punctured, its sides sparsely punctured; mesonotum, disc of scutellum, and postscutellum with sparse, but coarse punctures; lateral grooves distinct; sides of the scutellum and postscutellum closely punctured; mesopleura closely punctured, the punctures becoming sparse on the sternum, which is separated from the pleura by fine impressed lines, obsolete both anteriorly and posteriorly; surface of each mesopleurum swollen and uneven, with a small but deep pit on the posterior summit of the swollen part; superior surface of the propodeum mostly impunctate, with a broad median depressed channel, the posterior part of which, as well as the posterior surface on either side, is sculptured with large, shallow, irregular depressions; dorsal face of the propodeum separated from the posterior by a transverse carina; the lateral angles prominent, sharp, strongly and closely punctured, the punctures becoming obsolete on the depressed lower part of the sides; the posterior face of the propodeum almost vertical, somewhat hirsute.

Wing venation as shown in figure 7; the veins and stigma piceous.

Legs armed as described for *crassa*.

Abdomen sessile, the basal segment short, broad, and thick, enlarging directly from the base without any anterior neck, separated by a moderate constriction from the second ventral; the latter with a convex horizontal surface only, without a transverse carina; first segment coarsely and closely, but dorsally sparsely and finely punctate; remaining segments finely and sparsely punctured; pygidium truncate, its sides strongly margined, and with a median,

longitudinal, strongly raised fold, a few moderate punctures in the depressed area between this fold and the margin.

Sagitta much reduced, strongly chitinized, its tip transversely truncate, thickened and tricuspid; volsella a very small, compressed, strongly chitinized, oval plate; ramus large, broad, its apex deeply emarginate, its upper posterior angle acute, its inner surface without a hirsute patch, but with an oblique row of ciliae; squama, by reason of a deep posterior notch, bifurcate, the upper prong slender, acute; uncus rather short, much thickened before and acute at the apex, not at all notched (figures 24, 25 and 26).

In one paratype the vein r–m is almost opposite m–cu.

*Type material.*—Holotype: Nogales, Arizona, June 21, 1903, (E. J. Oslar), [Cornell University No. 124.1]. Four paratypes: Arizona, [American Entomological Society and Cornell University, No. 124.2].

This species finds its closest relatives in *castanea*, *crassa* and *thermarum*. The peculiar tricuspid sagittae I have not observed in any other species. Its general appearance distinguishes it at a glance from any other species of the genus.

**Brachycistis (Brachycistis) crassa** new species

♂. Brownish orange; femora orange; tibiae and tarsi yellow; wings stained slightly yellowish, the veins and stigma light brown; clothed with sparse yellowish pubescence. Length, 13 mm.

Head polished, shining, with punctures small and scattered; ocelli large, prominent, their measurements: .3 mm., .4 mm., .6 mm.; a weak longitudinal impression between the posterior ocelli, but no transverse line behind them; middle of the forehead above the base of the antennae elevated, without tubercles or carinae; inferior margin of each antennal socket thickened and produced into a strong triangular tubercle projecting downward; clypeus not tuberculate, elevated toward the apex, with thick and slightly emarginate margin; mandible with the inner two teeth strong, of equal size, a comparatively weak carina extending from the inner one about half way to the base; gular orifice small, its lateral margin removed from the eye by more than the length of the last segment of the labial palpus, and from the globular swelling at the condyle of the mandible by about twice the apparent width of the same. Antennae noticeably crenulate toward their apices.

Pronotum with unusually prominent, but not sharp, humeral angles, closely and coarsely punctured, the rest of its surface sparsely punctured; mesonotum polished, shining, with few punctures, and deeply impressed lateral grooves; scutellum with its disc sparsely punctate, laterally and posteriorly closely punctate as is also the postscutellum; mesopleura closely punctured, the punctures becoming sparse on the sternum, the surface irregular by reason of a superior wen, ending posteriorly in a chitinous tubercle; superior face of the propodeum impunctate, glabrous, and polished, with a longitudinal median bottle-shaped furrow, the dorsal face separated from the posterior by a sharp

transverse carina; the lateral angles prominent, sharp, and strongly punctured, the punctures becoming obsolete on the lower part of the sides; the posterior face strongly declivous and hirsute.

Wing venation as shown in figure 6; the veins and stigma brown, Sc+R+M very dark brown, the margin beyond the stigma slightly and indefinitely infuscated.

Anterior metatarsus with a few inconspicuous slender spines among the hairs which cover it; middle tibia with a group of ten or twelve prominent coarse spines on the apical half of its outer surface, two or three near the apex of the posterior edge being coarse and peg-like; posterior tibia with about six stout spines along its posterior margin and a few small ones scattered over the apical part of the outer surface and largely concealed by the hairs thereon.

Abdomen sessile; the basal segment short, broad and thick, enlarging directly from the base without any anterior neck, separated by a deep constriction from the second ventral; this segment with a convex horizontal surface, and a nearly vertical, plane, basal surface, the two separated by an undulating transverse chitinous ridge, entirely characteristic of the species; first segment coarsely and closely punctured, the others very polished and sparsely punctured; pygidium obtuse, its lateral margins indefinite, with a very slightly raised median area and numerous coarse lateral punctures.

Sagitta much reduced, each forming a thin edged, longitudinally rolled plate without apical processes or thickening; volsella reduced to a chitinous concealed tubercle; ramus large, without a hirsute patch on its inner side; squama thick, blunt, its apical margin notched but not deeply so; uncus of a form peculiar to this species, being deflexed and with the apical portion bent backward at an acute angle, its tip bifid and spread out, resembling the digits of a tree-toad (figures 21, 22, and 23).

*Type material.*—Holotype from Coalinga, Fresno County, California, June 1 to 3, 1907, below 500 ft. elevation (the author), [Cornell University, No. 125.1]. One paratopotype: same date, [Cornell University, No. 125.2]. One paratype from Calexico in the Imperial Valley, California, August 11, 1914, (the author), [Cornell University, No. 125.3]. Three paratypes from Nogales, Arizona, June 21 and 22, and July 10, 1903, (E. J. Oslar), [Cornell University, Nos. 125.4 to 125.6]. One paratype from Durango, Colorado, July 17, 1900, (E. J. Oslar), [Cornell University No. 125.7].

This species finds its closest relatives in *stygia*, *castanea* and *thermarum*. The transverse ridge on the second ventral segment, and the peculiar shape of the uncus with its upturned apex, abundantly distinguish it from any other known species.

**Brachycistis (Brachycistis) brevis** Fox, ♂.

*Genitalia:* Sagitta reduced to a short truncate lamella; volsella a small chitinous lobe; ramus short and broad, its upper hind angle acute, its inner side with a patch of setae; squama acute, with an entire margin; uncus rather long and slender, gradually widened to and truncate at the apex, somewhat deflexed (figures 34 and 38).

The description and figures of the genitalia are drawn from a specimen in the collection of Cornell University, that has been found, on comparison, to agree with the type.

California: [*Type*, American Entomological Society]; Calexico, August 11, 1914, 6♂, [Cornell University].

**Brachycistis (Brachycistis) eremi** new species

♂. Brownish orange; the mouth parts, antennae and legs yellow; a spot between the ocelli black; sparsely clothed with yellowish pubescence; wings hyaline, the veins pale, washed with brownish yellow, the stigma and Sc + R+ M brown. Length, 9 mm.; slender.

Head polished, with a few small punctures; ocelli large, prominent, without an impressed line behind or between them, their measurements: .25 mm., .23mm., .3m.; forehead with a transverse row of four tooth-like tubercles above the antennae; inferior margin of each antennal socket thickened and with a tubercle projecting downward; clypeus raised toward a premarginal median point, which as seen from the side appears as a prominent tubercle, from this abruptly declivous to the scarcely concave edge; teeth of the mandible in the type much worn, in paratypes the inner two are of equal size, acute, a carina extending from the inner one about half-way toward the base of the mandible; gular orifice small, its margin distant from the eye by considerably more than the length of the last segment of the labial palpus, and from the globular swelling at the condyle of the mandible by more than its width. Antennae crenulate toward their apices.

Pronotum with humeral angles not prominent, its entire surface rather sparsely punctured; mesonotum polished and shining, bearing a few scattered punctures and deeply impressed lateral grooves; scutellum with a few scattered punctures on its disc, its sides closely finely punctured; postscutellum with disc impunctate, the sides closely, finely punctured; mesopleura evenly but coarsely punctured, more sparsely toward the sternum, the surface prominently but not irregularly swollen, with a low tubercle near the upper part of the posterior margin of each; dorsal surface of the propodeum not punctured, except its sides, with a median area separated on either side by a carina, dorsal and posterior surfaces not separated by a transverse carina, the lateral angles rounded, not prominent, and no distinct line of separation between the dorsal, posterior and lateral faces; lateral angles coarsely but not rugosely punctured, the punctures extending forward along the upper part of the lateral surface and sides of the dorsal surface; the posterior face strongly declivous, with a few erect hairs and inconspicuous "spatter-punctures."

Wing venation as shown in figure 9.

Anterior metatarsus without noticeable spines; middle tibia with one or two inconspicuous spines near its apex on the outer surface, and two or three strong ones on the apical part of its posterior edge; posterior tibia with two or three spines on its posterior edge.

Abdomen sessile, its first segment short, broad, and thick, enlarged from almost the very base, without or with scarcely any anterior neck, rather deeply constricted from the second, its sides coarsely punctured; dorsally, like the rest of the abdomen it has few and small punctures; pygidium deeply emarginate, its sides margined, but not strongly, with a median, longitudinal, elevated, impunctate fold, between which and the sides are four or five coarse punctures.

Sagitta much reduced, weakly chitinized, as seen from the side squarely truncate, as seen from above, strongly compressed, the ends rolled outward; volsella a small compressed button; ramus moderately broad, its posterior margin emarginate, its superior hind angles not produced, bluntly rounded, its inner surface with a brush of a few weak hairs; squama acute, its posterior margin not notched; uncus deflexed, the basal half strongly compressed, the apical half flaring, truncate (figures 28 and 29).

*Type material.*—Holotype: Calexico in the Imperial Valley, California, August 11, 1914, (the author), [Cornell University, No. 126.1]. Thirteen paratopotypes: same date. The figures and description of the genitalia are from a paratype.

The position of the insertion of r–m on M in the front wings varies from slightly basad to slightly apicad of m–cu.

This species finds a very close ally in *B. brevis* Fox. In that species, in addition to the characters used in the key, the uncus appears more trumpet shaped as seen from above, and the squamae are less slenderly acute.

**Brachycistis** (**Brachycistis**) **perpunctata** Cockerell, ♂.

The wings are illustrated in figure 20.

New Mexico: Las Cruces, *type*. California: Claremont, 1 ♂, and mountains near Claremont, 1♂, (C. F. Baker), [Cornell University and Pomona College].

**Brachycistis rutilans** (Blake), ♀.

A specimen before me agrees entirely with the type, but is in much better condition.

In describing this species Mr. Blake remarks that it differs from all others in the entire absence of pubescence. As a matter of fact the pubescence has simply been rubbed off of the type specimen. An examination shows not only the same close arrangement of minute punctures originally bearing the decumbent pubescence, and sparser larger punctures for the erect hairs, that

occurs in my specimen, but also bits of the pubescence still remaining in protected parts of the insect's anatomy.

In view of this fact, Mr. Blake's description is misleading and the following partial description will correct it.

Head everywhere very minutely and closely punctulate, the punctures having very short, white, decumbent pubescence, and except on the front, also with scattered, erect, white hairs born in larger punctures. Thorax, except the pleura and posterior face of the proprodeum with a similar arrangement of pubescence; the pleura practically bare, slightly and irregularly aciculate; the propodeum with scattered, erect white hairs, but without the decumbent sericeous pubescence. The pubescence of the abdomen is somewhat complicated; dorsally, the cephalic slope of the basal segment has erect white hairs, the apex of each segment with a band of short erect black or dark hairs, interrupted medially on the second and fifth segments; two lateral yellow spots near the base of the second segment, a median one at the apex of the same, and a large median spot on the fifth segment are covered with short white hairs; each segment, especially apically, except the last, also bears long and scattered, dark, reddish hairs, some paler; ventrally the second segment bears sparse, short, white pubescence and longer scattered hairs, the third, fourth and fifth segments with erect pale hairs at apex, and the sixth with scattered darker hairs.

California: [*Type*, American Entomological Society]; Felton in the Santa Cruz Mountains, May 20 to 25, 1907, between 300 and 500 feet elevation, 1 ♀, (the author), [Cornell University].

**Brachycistis bimaculata** Fox, ♀.

Missouri: Ripley County, (P. J. Schmitt), [*Type*, American Entomological Society]. Virginia: Falls Church, August 15, September 18, 2 ♀, (N. Banks), [N. Banks and Cornell University].

*Unidentified species*

**Brachycistis (Brachycistis) cremastogaster** Melander, ♂.

1903. *Brachycistis cremastogaster* Melander, Trans. Amer. Ent. Soc., 29: 329, ♂.

Texas: [Chicago Academy of Sciences].

**Brachycistis (Brachycistis) stictinota** Viereck, ♂.

1906. *Brachycistis stictinotus* Viereck, Trans. Amer. Ent. Soc., 32: 190, ♂.

I know of no other record of a species of this genus from as far east as Kansas.

Kansas: Clark County, 1962 feet elevation, June, 1 ♂, [*Type*, University of Kansas].

Subgenus **Brachycistellus** Baker

Two undescribed species before me agree with the genotype in venation, but lack the high arched mesonotum described by Baker and have the ocelli enlarged. I have not seen the genotype, but I can not look upon the two here described as being more than subgenerically distinct from *Brachycistis*.

Type: *Brachycistellus figitiformis* Baker, genus monobasic.

A Key to the Species of the Subgenus Brachycistellus

1. Ocelli minute; mesonotum very high, arched..... **figitiformis** (Baker)
   Ocelli very large; mesonotum not particularly high, convex but not strongly arched ..... (2)

2. Hind ocelli about equidistant from each other and from the eyes; from a lateral view the short first abdominal segment is rather gibbous, strongly constricted dorsally from the second; length, 3.2 mm.
   **paupercula** new species
   Hind ocelli nearly twice as far from each other as from the eyes; from a lateral view the short first segment is not gibbous and not at all constricted dorsally from the second; length, 4.7 mm..... **marcida** new species

**Brachycistis (Brachycistellus) figitiformis** (Baker), ♂.

1907. *Brachycistellus figitiformis* Baker, Invertebrata pacifica, 1:178.

California: Claremont, 1 ♂, *type* (C. F. Baker), [Pomona College ? ].

**Brachycistis (Brachycistellus) paupercula** new species

♂. Piceous, *i.e.* a little darker than Vandyke brown, the legs except the coxae, the antennae, and the tegulae honey yellow. Wings hyaline, the veins very pale, the stigma piceous. Length, 3.2 mm.

Surface of the head and thorax polished and shining, with a few remote and large punctures, bearing erect hairs; diameter of the hind ocelli .13 mm., their distance from the eyes .13 mm., from each other .17 mm., from the front ocellus .06, diameter of the latter .13 mm.; front without ridges or tubercles above the antennae, the rim of the antennal sockets not thickened beneath; clypeus elevated into a prominent, somewhat transverse tubercle, its anterior margin weakly emarginate; mandibles without a distinct carina on the surface, with two preapical teeth.

Humeri rounded; pronotum large; mesonotum convex, without furrows except two lateral furrows posteriorly; scutellum prominently convex; propodeum short, rounded, without angles, with a median longitudinal furrow, without carinae, its surface especially laterally a little tessellated.

Spines of the tibiae very inconspicuous. Wing venation as shown in figure 50.

First abdominal segment short and stout, the second very deep; last dorsal segment without a distinct pygidial area, its apex reflexed and slightly emarginate; surface of the abdomen shining, but with rather long setae more numerous than on the thorax.

California: Calexico, August 11, 1915, 1 ♂, (J. C. Bradley), [Cornell University].

*Type:* Cornell University no. 129.1

**Brachycistis (Brachycistellus) marcida** new species

♂. Piceous, *i.e.* a little darker than Vandyke brown, the antennae, tegulae and the legs except the coxae testaceous, almost honey yellow. Wings hyaline, the veins weak, the stigma piceous. Length, 4.7 mm.

Surface of the head and thorax polished, with scattered large punctures bearing long hairs; front prominent between the ocelli; the hind ocelli .17 mm. in diameter, .17 mm. from the eyes, .28 mm. from each other, .11 mm. from the front ocellus, the diameter of which is .14 mm.; front, antennal sockets and clypeus as in the preceding species; mandibles with two equal teeth placed side by side before the apex, the surface without carinae.

The thorax, legs, and wings as in the preceding species, except that the marginal cell extends by about the width of the vein $R_3$ beyond the end of the stigma.

The abdomen, except for the first and last segments is like the preceding; there is a weakly marked pygidial area, smooth medially, laterally with punctures and a weak bordering ridge, posteriorly the edge is not reflexed.

California: Calexico, August 11, 1914, 1 ♂, (J. C. Bradley), [Cornell University].

*Type:* Cornell University no. 130.1

**CHYPHOTES** Blake

Type: *Chyphotes elevatus* Blake, (genus monobasic).

In the following table to males, two described species are omitted, *piceiceps* Baker and *californicus* Baker. They each fall in category 5, but Mr. Baker has not mentioned the characters by which I further subdivide that section of the genus, and as I have not seen either species, I am unable to include them,

*Males*

1. Front wings with veins $R_4$ and $R_5$ both present, therefore with three submarginal cells.....(2)
   Front wings with vein $R_5$ lacking, therefore with two submarginal cells. (5)
2. Fourth and fifth ventral segments armed with a comb of several stiff bristles on each side near the apex.....(3)
   Fourth and fifth ventral segments without such a comb.....(4)
3. Second segment of the petiole strongly gibbous, its sides very markedly convex; $R_4$ and $R_5$ nearly straight, parallel, the cell $R_4$ quadrate.
   **nubeculus** (Cresson)

Second segment of the petiole swollen but not strongly gibbous, its sides but slightly convex; $R_4$ and $R_5$ sinuate, slightly divergent above, the cell $R_4$ nearly rhomboidal..... **heathii** Melander

4. Length, 7 to 8 mm.; head piceous; second segment of flagellum longer than the first..... **similis** Baker
Length, 11 to 12 mm.; head concolorous; second segment of the flagellum of a length equal to that of the first..... **albipes** (Cresson)

5. Metasternum with a strongly elevated prominence in front of each coxa; mesosternum with a small tooth cephalo-mesad of each coxa.....(6)
Metasternum with a small tubercle in front of each coxa; mesosternum with a transverse ridge in front of the coxae (Lower California).
**peninsularis** Fox

6. Apical part of petiole ovate.....(7)
Apical part of petiole globose; posterior ocelli nearer the compound eyes than to each other..... **calexicensis** new species

7. Pubescence on apical portion of abdomen yellow; abdomen castaneous throughout..... **melaniceps** (Blake)
Pubescence on apical portion of abdomen white; third dorsal segment black or with a transverse black band..... **belfragei** (Blake)

*Females*

As I have not studied the females of this genus I refer the reader to the table by Fox.[6] As *peculiaris* (Cresson) is now removed to another genus, the table may be commenced at category 2.

**Chyphotes peninsularis** Fox, ♂.

Lower California: [*Type*, American Entomological Society].

**Chyphotes calexicensis** new species

♂. Two submarginal cells, the second as long as the first; metasternum with two strong, flattened processes; petiole very strongly gibbous behind; pubescence yellowish at tip of the abdomen.

Testaceous, head except face black; abdomen reddish-testaceous; flagellum yellow; scape and legs pale straw-colored; face and base of mandibles testaceous, their tips black; entire insect covered with very noticeable, long, silky, white pubescence, stained yellow toward the apex of the abdomen. Length, 12.5 mm.; of fore-wing, 8.4 mm.

[6]Transactions of the American Entomological Society, 1899, 25: 275.

As seen from above the head is but slightly narrowed behind the eyes, rather distinctly truncate caudad, the occiput margined; from in front the eyes appear very prominent and bead-like, reaching the base of the mandibles, and converging below; from a lateral view the cephalic surface of the head is nearly plane, the temples about as wide as the posterior ocellus; the eyes appear black polished, the facets not visible under a low power; the vertex, occiput, temples, and gular regions are black, moderately coarsely but sparsely punctate, the punctures bearing both erect, white and short, sparse, decumbent hairs; the ocelli are large and prominent, the posterior pair slightly larger than the anterior one, placed slightly nearer to the compound eyes than to each other, the vertex between the three forming a raised triangular area; there is a groove extending from the anterior ocellus to between the antennae, which are approximate, almost attingent, their bases sheathed each by a scale-like projection of the frons; elevation of the latter higher than that of the face; clypeus and face not separated, together convex, coarsely punctured, the apex rather deeply emarginate, beneath which the labrum is apparent, fringed with long white hairs; face, including the projections of the frons at the base of the antennae, the labrum, and the bases of the mandibles, testaceous; a portion of the face laterad of the convex central part is plane smooth and impunctate; just below the antennae it is noticeably depressed; mandibles rather long, slender, evenly curved, with a single blunt tooth within, dark toward their apices; mouthparts testaceous, the second segment of the apparently four-segmented labial palpi wide and flattened. Antenna filiform, yellow, the scape paler than the rest, bearing white hairs, the flagellum naked except for a very fine, close and short puberulence; scape and pedicel together a little shorter than the following segment, the pedicel on its outer (longest) side about one-third the length of the following segment, much less within; no distinct area differentiated from the rest at the base of the first flagellar segment, such as is noticeable in some species.

Pronotum dorsally and laterally coarsely but not closely punctured, with erect and a small quantity of inconspicuous decumbent pubescence; propleura mostly smooth, with only a few scattered hairs, except for a conspicuous brush of straight, closely set, white hairs in front of each coxa; mesonotum and scutellum sculptured very much like the head and pronotum, the lateral lines almost obliterated; scutellum with its white hairs longer than on the mesonotum, moderately truncate, its sides weakly margined anteriorly; postscutellum convex and prominent; pleura more closely and roughly punctured than the dorsum, the vestiture similar; mesosternum produced on each side in front of the middle coxae into a sharp tooth pointing caudo-ventrad, the two connected by a weak ridge, from which a weak median carina projects caudad on the metaventer, on the latter, in front of each posterior coxa, a long flattened mammiliform process, projecting due ventrad; propodeum strongly and coarsely reticulate, the reticulations smaller on the sides.

Wings milky, with a fuscous spot along the costal margin beyond the venation; the veins and stigma weak and flavous; C and Sc + R + M each with a double row of stout, rather long hairs, the two rows more or less merged on C

and continued onto the stigma; other veins with a few groups or short rows of similar hairs; venation as shown in figure 4.

Legs honey-yellow, with conspicuous erect white hairs, the tibiae bearing in addition short pubescence, and the tarsi dense appressed pubescence, amongst which red spines are partially concealed; posterior metatarsus nearly as long as the remaining segments united, longer than the following three.

Anterior portion of the petiole enlarged, somewhat gibbous posteriorly, the posterior part greatly swollen, subglobose, strongly convex below, but less strongly than above (see the text figure), its ventral surface without median keel or prominence; the petiole and the following segment above and below coarsely punctured and clothed with sparse, erect, white hairs; the second ventral segment with a median longitudinal fossa; remaining segments finely and less roughly punctured, their vestiture more dense, on the venter gathered most thickly along the apical margins, yellow toward the apex of the abdomen.

Fig. 1. Petiole of *Chyphotes calexicensis* new species.

This species is most closely allied to *belfragei* and to *nigriceps*, from which it may be differentiated by the character employed in the table.

From *piceiceps* Baker and *californicus* Baker, which fall in this section of the genus, and both of which are omitted from the foregoing key to species, *calexicensis* may be distinguished by having its posterior ocelli placed distinctly nearer to the compound eyes than to each other, while in the two former the reverse is the case.

*Type.*—California: Imperial County, August 11, 1914, 1 ♂, (the author), [Cornell University, No. 127.1].

**Chyphotes nubeculus** (Cresson), ♂.

Colorado: [*Type*, American Entomological Society, no. 1889]; Denver, (recorded by Melander). New Mexico: Las Cruces, San Marcial and Santa Fe (collected by T. D. A. Cockerell and recorded by Melander).

**Chyphotes heathii** Melander, ♂.

1903. *Chyphotes heathii* Melander, Trans. Amer. Ent. Soc., 29: 326, ♂. Pl. IV, fig. 61, forewing.

California: Pacific Grove, May, 1901. 1 ♂, (Dr. Harold Heath), [*Type*, A. L. Melander]; Claremont (C. F. Baker), [Cornell University].

**Chyphotes similis**, Baker, ♂.

1903. *Chyphotes similis* Baker, Invertebrata pacifica, 1:116, ♂.

California: Claremont.

**Chyphotes albipes** (Cresson), ♂.

1903. *Chyphotes nevadensis* Baker, Invertebrata pacifica, 1: 116, ♂.

A careful comparison of the type with the description of *C.*

*nevadensis* Baker shows no significant points of difference, as Baker seems to have suspected might be the case. The distinction which he points out that, as stated by Fox, *albipes* has "the first and second transverse cubital veins uniting above" is not true of the type specimen of *albipes*. The two approach more or less closely but do not unite, and on one side are quite appreciably separated along the vein $r$–$R_3$.

In the type the first and second segments of the flagellum measure each .057mm., in one paratype each .061mm., while in the other paratype the antennae are broken. The characters used by Baker in his key in regard to the sculpture of the propodeum, would separate the type of *albipes* from *similis*, but seem subject to some variation, the condition in the paratypes somewhat approaching the condition described for *similis*.

COLORADO. NEVADA: [*Type*, American Entomological Society, no. 1888]; Kings Cañon, Ormsby County, *type* of *nevadensis*.

**Chyphotes melaniceps** (Blake), ♂.

Two specimens before me from California differ from the type in possessing a head which is concolorous with the rest of the body, instead of being black.

ARIZONA: (The type locality as given by Blake, but the type specimen bears no locality label). CALIFORNIA: Coalinga, Fresno County, June 1 to 3, 1907, 2 ♂, (the author), [Cornell University].

**Chyphotes belfragei** (Blake), ♂.

TEXAS: Fedor and Austin, (recorded by Melander). NEW MEXICO: Mesilla Park, (recorded by Melander); Albuquerque, July 18, 1902, (Oslar), [Cornell University]; Sandia Mountains, August 14 to 21, elevation 6500 to 7500 ft., 1 ♂, in "Open stand of juniper, piñon and cedar, with an abundance of annuals and perennials. Rainfall 10 to 15 inches per annum," (A. J. Jaenicke), [Cornell University]. ARIZONA: Huachuca Mountains, August 15, 1903, 1 ♂, (Oslar), [Cornell University]; Nogales, July 30, 1903, 1♂, (Oslar), [Cornell University]. COLORADO: Durango, 1♂, [Cornell University].

**Chyphotes piceiceps** Baker, ♂.

1903. *Chyphotes piceiceps* Baker, Invertebrata pacifica, 1:116, ♂.

This species and the following I have not seen.

CALIFORNIA: Claremont, *type*.

**Chyphotes californicus** Baker, ♂.

1903. *Chyphotes californicus* Baker, Invertebrata pacifica, 1:116, ♂.

CALIFORNIA: Claremont.

**Chyphotes elevatus** (Blake), ♀.

**Chyphotes punctatus** Fox, ♀.

**Chyphotes testaceipes** Fox, ♀.

**Chyphotes petiolatus** Fox, ♀.

### **TYPHOCTES** Ashmead

1899. *Typhoctes* Ashmead, Journ. N. Y. Ent. Soc., 7:53.

Type: *Mutilla peculiaris* Cresson (by original designation).

**Typhoctes peculiaris** (Cresson), ♀.

1899. *Typhoctes peculiaris* Ashmead, Journ. N. Y. Ent. Soc., 7: 53.

California [*Type*, American Entomological Society, no. 1890]. New Mexico: Mesilla Park, (T. D. A. Cockerell, recorded by Melander).

**Typhoctes attenuatus** (Blake), ♂.

1903. *Chyphotes attenuatus* Melander, Trans. Amer. Ent. Soc., 29: 330, pl. IV, fig. 63 forewing.

1903. *Typhoctes attenuatus* André, Genera insectorum, fasc. 11, p. 11.

Texas: (Belfrage), [*Type*, American Entomological Society]. New Mexico: Mesilla Park and Santa Fé (recorded by Melander). Arizona: Huachuca Mountains, August 17, 1903, 1 ♂ (Oslar), [Cornell University]; Phoenix, March 20, 1902, 1 ♂, (Oslar), [Cornell University].

## EXPLANATION OF PLATES

### Lettering on plates XXIII to XXV

A. *Uncus;* crochet, Radoszkowski.
B. *Squama;* branche du forceps, Radoszkowski.
C. *Sagitta;* tenaculum. Radoszkowski.
D. *Volsella;* volsella, Radoszkowski.
E. *Ramus;* la base du forceps, Radoszkowski.

## Plate XX

### Wings

Drawn by the author from balsam mounts, projected by the Edinger apparatus.

Fig. 1.—*Myrmosa* (*Myrmosula*) *parva* Fox.
Fig. 2.—*Myrmosa* (*Myrmosa*) *unicolor* Say.
Fig. 3.—*Typhoctes attenuata* (Blake).
Fig. 4.—*Chyphotes calexicensis* Bradley; holotype.
Fig. 5.—*Brachycistis* (*Brachycistis*) *carinata* Fox; homotype.

Veins lettered according to the Comstock-Needham system of venation.

## Plate XXI

### Wings

Drawn by the author from balsam mounts, projected by the Edinger apparatus.

Fig. 6.—*Brachycistis* (*Brachycistis*) *crassa* Bradley; paratype.
Fig. 7.—*Brachycistis* (*Brachycistis*) *stygia* Bradley; paratype.
Fig. 8.—*Brachycistis* (*Brachycistis*) *castanea* Fox; homotype.
Fig. 9.—*Brachycistis* (*Brachycistis*) *cremi* Bradley; paratype.
Fig. 10.—*Brachycistis* (*Brachycistis*) *thermarum* Bradley; holotype.
Fig. 11.—*Brachycistis* (*Brachycistis*) *noctivaga* Bradley; holotype.
Fig. 12.—*Brachycistis* (*Brachycistis*) *contigua* Fox; homotype.
Fig. 13.—*Brachycistis* (*Brachycistis*) *ioachincnsis* Bradley; paratype.

## Plate XXII

### Wings

Drawn by the author from balsam mounts, projected by the Edinger apparatus.

Fig. 14.—*Brachycistis* (*Brachycistis*) *eriopis* Bradley; holotype.
Fig. 15.—*Brachycistis* (*Brachycistis*) *micromnata* Bradley; holotype.
Fig. 16.—*Brachycistis* (*Brachycistis*) *arcnivaga* Bradley; paratype.
Fig. 17.—*Brachycistis* (*Brachycistis*) *nuda* Fox.
Fig. 18.—*Brachycistis* (*Brachycistis*) *dentata* Bradley; paratype.
Fig. 19.—*Brachycistis* (*Brachycistis*) *nocticola* Bradley; paratype.
Fig. 20.—*Brachycistis* (*Brachycistis*) *perpunctata* Cockerell.
Fig. 50.—*Brachycistis* (*Brachycistellus*) *paupercula* Bradley; holotype.

## Plate XXIII

Male genitalia

Figs. 21 to 26, 28 and 29 drawn by Miss Margaret Moles, from dry mounts, x 30.

Figs. 27 and 30 drawn by the author from a balsam mount, x 30.

Fig. 21.—*Brachycistis crassa* Bradley; holotype; dextral aspect.
Fig. 22.—*Brachycistis crassa* Bradley; holotype; dorsal aspect, right half.
Fig. 23.—*Brachycistis crassa* Bradley; holotype; dextral aspect of left half.
Fig. 24.—*Brachycistis stygia* Bradley; holotype; dextral aspect.
Fig. 25.—*Brachycistis stygia* Bradley; holotype; dorsal aspect of right half.
Fig. 26.—*Brachycistis stygia* Bradley; holotype; dextral aspect of left half.
Fig. 27.—*Brachycistis castanea* Fox; homotype; dextral aspect, from slide mounted in balsam.
Fig. 28.—*Brachycistis eremi* Bradley; paratype; dextral aspect.
Fig. 29.—*Brachycistis eremi* Bradley; paratype; dorsal aspect, right half.
Fig. 30.—*Brachycistis castanea* Fox; paratype; dextral aspect of left half.

## Plate XXIV

Male genitalia

Drawn by Miss Margaret L. Moles, from dry mounts, x 38.

Fig. 31.—*Brachycistis thermarum* Bradley; holotype; dextral aspect.
Fig. 32.—*Brachycistis thermarum* Bradley; holotype; dorsal aspect of right half.
Fig. 33.—*Brachycistis thermarum* Bradley; holotype; dextral aspect of left half.
Fig. 34.—*Brachycistis brevis* Fox; dextral aspect.
Fig. 35.—*Brachycistis noctivaga* Bradley; holotype; dextral aspect.
Fig. 36.—*Brachycistis noctivaga* Bradley; holotype; dorsal aspect of right half.
Fig. 37.—*Brachycistis noctivaga* Bradley; holotype; dextral aspect of left half.
Fig. 38.—*Brachycistis brevis* Fox; dorsal aspect of left half.
Fig. 39.—*Brachycistis nocticola* Bradley; holotype; dextral aspect.
Fig. 40.—*Brachycistis nocticola* Bradley; holotype; dorsal aspect of right half.
Fig. 41.—*Brachycistis arenivaga* Bradley; holotype; dorsal aspect of right half.
Fig. 42.—*Brachycistis arenivaga* Bradley; holotype; dextral aspect.

## Plate XXV

Male genitalia

Drawn by the author, from dry mounts, x 66.

Fig. 43.—*Brachycistis nevadensis* Fox; holotype; dextral aspect of left half.
Fig. 44.—*Brachycistis carinata* Fox; homotype; dextral aspect.
Fig. 45.—*Brachycistis dentata* Bradley; holotype; dextral aspect of left half.
Fig. 46.—*Brachycistis triangularis* Fox; paratype; dextral aspect.
Fig. 47.—*Brachycistis triangularis* Fox; paratype; dorsal aspect of uncus.
Fig. 48.—*Brachycistis elegantula* Cockerell; paratype?; dextral aspect.
Fig. 49.—*Brachycistis inaequalis* Fox; paratype; dextral aspect of left half.

# COSTA RICAN DIPTERA

## COLLECTED BY PHILIP P. CALVERT, PH.D., 1909-1910

## Paper 2.—Tabanidae and Asilidae

BY JAMES S. HINE

The material in these two families of Diptera collected by Dr. P. P. Calvert[1] is of more than ordinary interest, as our knowledge of the range of several species is greatly extended, some new and rare species are presented for study, and the need of further collecting in the region emphasized, if the published results of work done on the faunas of Central and South America are to be harmonized. As a rule the species from the southern parts of North America and the northern parts of South America have been published separately, in some cases without due attention to distribution. My main interest in this region is a study of the range southward of species of the family Tabanidae, especially, occurring in North America. Besides the Costa Rican material in Dr. Calvert's collection I have used much other material from Mexico, Central America and South America and have given such observations on distribution as the specimens and facts at hand furnished.

## TABANIDAE

**Pangonia prasiniventris** Macquart

1846. *Pangonia prasiniventris* Macquart, Dipt. Exol., Suppl., i, 29.

Three male specimens taken December 23, 1909, with the note "in road south of Turrúcares." The green or greenish abdomen, darkened toward the tip, and yellowish wings, thorax and legs suggest the species. Macquart's type is reported as having been taken in Colombia, Schiner had seven males and six females from South America, and Osten Sacken had four males from Panama and Colombia. Besides Dr. Calvert's specimens there

[1] For data on the localities in which the collection was made, see these Transactions, xl, pp. 1 to 8 (1914), and on the dates of collecting, Appendix I, pp. 493 to 500, of "A Year of Costa Rican Natural History" by A. S. and P. P. Calvert, New York, Macmillan, 1917.

are before me two females from Carillo, Costa Rica, two females from Ecuador and one female from Bartica, British Guiana, collected by Parish. While walking along the railroad at Los Amates, Guatemala, I procured a female specimen of this species from a cow where it was taking blood. From specimens at hand the range may be given as Guatemala to Ecuador and British Guiana.

**Erephrosis niger** Ricardo

One female specimen from Peralta Station, Costa Rica, August 10, 1909. Miss Gertrude Ricardo described the species in Annals and Magazine of Natural History, Series 7, Volume vi, page 292, from a male from Surinam. There is before me a male taken at Bartica, British Guiana, by H. S. Parish, March 20, 1901. Nothing on the habits of the species is available. [This is the species mentioned as *Pangonia pyrausta* in our "A Year of Costa Rican Natural History," page 258.—P. P. Calvert.]

**Chrysops tanyceras** Osten Sacken

1886. *Chrysops tanyceras* Osten Sacken, Biol. Cen.-Am., Dipt., i, 46.

More than a dozen specimens taken at Peralta Station, March 10, 23, 25 and 26, 1910. There are four species of *Chrysops* from New Mexico, Mexico and Central America with the first and second segments of the antennae elongate and the third segment abnormally short.

They may be separated by the following table:

1. First antennal segment decidedly longer than the second.....2
   First and second antennal segments nearly equal in length.....3
2. Whole body, including the wings and legs, uniformly black or dark brown. **melanopterus** Hine
   Body brown, abdominal segments with an apical gray margin which expands into a small triangle at the middle, legs mostly yellow, wings hyaline with the cross-veins and furcation of the third vein margined with brown.....**tanyceras** Osten Sacken
3. Body nearly uniform brown without perceptible gray on the sides and posterior margins of the thorax and abdominal segments..**ceras** Townsend
   Body brown with distinct gray on the sides and posterior margins of the thorax and abdominal segments.....**megaceras** Bellardi

It is very easy to distinguish *melanopterus* on account of its uniform black color, but the other three species are much alike in general appearance. The frontal callosity is normal for *Chrysops* in *ceras*, but of a different type in the others.

I collected *melanopterus* near Puerto Barrios, Guatemala and found the species very persistent in following me, as is common with various species of *Chrysops*, and taking every opportunity to bite that offered.

**Stibasoma flavistigma** Hine

1912. *Stibasoma flavistigma* Hine, Ohio Nat. xii, 516.

One specimen taken at Guacimo, June 6, 1909. The type of this species was taken at Vera Cruz, Mexico. These two specimens are all that I have seen and, so far as I know, all that have been reported. A rather wide range is indicated by the capture of a specimen so far from the type locality.

**Dichelacera grandis** Ricardo

Three female specimens taken at Juan Viñas, July 27 and 30, and August 3, 1909. Miss Ricardo described *grandis* in Annals and Magazine of Natural History, Series 7, Volume xiv, page 371, from specimens taken at Belize, British Honduras. These specimens vary slightly from the description of the type, but in general they agree well. Dr. Adolpho Lutz recently described *D. submarginata* from Brazil and his species is somewhat like *grandis*, but a comparison of specimens with the colored figure which he gives reveals a number of specific differences. Miss Ricardo compares *grandis* with *cervicornis* and points out that the two are different in the form of the wing bands. There is some indication, however, that they have been confused by previous writers and from this standpoint there is some doubt whether *cervicornis* is a North American species at all, although Miss Ricardo records it from David, Panama in the same paper in which she describes *grandis*.

If we admit *cervicornis* to the North American fauna, from the records, we have five species which may be separated by the following table:

1. General color of the body dark, nearly black.....2
   General color of the body yellow.....3
2. Thorax yellowish gray pollinose with a shining black crossband.
   **scapularis** Macquart
   Thorax black with two golden pilose spots on the anterior half.
   **pulchra** Williston
3. Smaller species, apex and inner border of the wing nearly uniformly infuscated.....**marginata** Macquart
   Large species, wings in large part yellowish hyaline.....4

4. Band of the wing as two half bands.....**cervicornis** Fabricius
Band of the wing as one entire band.....**grandis** Ricardo

The distribution records of these five species show that all of them have quite a wide range, and that some of them have been taken in South America far below the equator. *D. scapularis* has been reported by Bellardi from Tehuantepec and I have seen numerous specimens from Vera Cruz. A male specimen collected by myself at Puerto Barrios, Guatemala is referred here with some doubt.

There is before me a female specimen of *D. emarginata* from the state of Chiapas and numerous others from British Guiana, while Lutz reports specimens from Pará, Brazil.

There appears to be no other record for *pulchra* except the type locality, which is the state of Guerrero, Mexico.

The known range of *grandis* is British Honduras to Costa Rica.

Lutz indicates that the distribution of *cervicornis* is from Panama south to the state of Espirito Santo, Brazil and to Peru, thus establishing the fact that its range is more southern than any of the others mentioned. He calls attention also to Williston's improbable Mexican records, which the author himself considered doubtful at the time he wrote them.

As most of the work in this genus has been with female specimens, there are further problems for solution when the males of the various species are fully considered.

**Tabanus quadripunctatus** Fabricius

1805. *Tabanus quadripunctatus* Fabricius, Syst. Antl, 99.

Four specimens. Three of them taken at Juan Viñas, February 17, 1910, the other from Cerro Jocosal, February 28. Bellardi called this species *nigropunctatus* and reported it from Cordova and Huastec, Mexico. Osten Sacken had it from Guatemala, Costa Rica and Brazil. My own collecting in Guatemala produced the species from Santa Lucia and Laguna. Several specimens of both sexes were observed flying over water and alighting on protruding stones.

There are a number of specimens before me from Brazil and British Guiana also. Fifteen specimens show a range in size from twelve to eighteen millimeters in total length, but most of them are very near sixteen millimeters long.

**Tabanus alteripennis** Walker

1860. *Tabanus alteripennis* Walker, Trans. Ent. Soc. London, v, 274.

There are three descriptions of Tabanids that seem to be rather close so far as coloration and wing markings are concerned. Walker described *alteripennis* from Mexico, Osten Sacken described *erebus* from Costa Rica and Bellardi described *caliginosus* from Mexico. The length of the first one is given as four and one-half lines, that of the second as thirteen to fourteen millimeters, and that of the third as twelve millimeters. Four specimens from Juan Viñas measure from seven to nine millimeters and are of the proper length therefore for *alteripennis*. Osten Sacken suggested the close relationship of *alteripennis* to his species, and Williston holds the opinion that *erebus* is the same as *caliginosus*. The striking difference in size indicated leads one to defer the question of synonymy until more material is available.

The wing is brown with a large hyaline spot including the apical half of both basal cells and parts of other cells in that region, another hyaline spot includes the apex of the discal cell and the bases of second and third posterior cells, and a third hyaline spot just before the furcation of the third vein. The body is nearly uniform brown with the apex of the abdomen dark, nearly black. The front is exceptionally narrow and the antenna is yellow with the annulate portion of the third segment black.

**Tabanus venenatus** Osten Sacken

1886. *Tabanus venenatus* Osten Sacken, Biol. Cent.-Am., Dipt., i, 54.

One specimen, Peralta Station, 1088 ft. alt., March 10, 1910. The third segment of the antenna is very deeply excised forming two branches. General color brown; wing pale brownish, more intense in the region of the stigma and continuing backward as a wide band, but fading out before the hind border is reached. Osten Sacken's specimens are from Guatemala and Panama.

**Tabanus fenestra** Williston

1887. *Tabanus fenestra* Williston, Trans. Kans. Acad. Sci., x, 141.

Two specimens marked Costa Rica. The type is from San Domingo, and there is before me a specimen from Sanchez, San Domingo. The uniform dark color of the body is distinctive. Thorax dark brown, femora dark, tibiae, tarsi and antennae yellow; wings smoky, darkest anteriorly. Abdomen black with white bloom.

**Tabanus trilineatus** Latreille

1814. *Tabanus trilineatus* Latreille, Humb. & Bonp. Rec. Obs., fasc. x, 116.

One specimen from Cachí, March 3, 1910. There are a number of species in Mexico, Central America and South America closely related to *trilineatus*. *T. costalis* and *lineola* from the United States also are related to it. Some of the species have hairy eyes and some of them do not. A careful study of extensive collections is necessary in order to fully conclude as to the names to be used in future. Until this is done it is impossible to understand the distribution of the various species concerned.

## ASILIDAE

**Holcocephala nitida** Wiedemann

1830. *Dasypogon nitidus* Wiedemann, Auss. Zweifl, Ins., ii, 643.

One specimen labelled "West of Cachí." Williston identified several specimens from various places in southern Mexico.

**Deromyia** species

A female specimen, Juan Viñas, near Rio Reventazon, 2500 ft. alt., June 28, 1909, belonging to this genus does not agree with any species I know from North America. It is in first class condition but being a female I prefer not to name it. The palpi are black, legs and antennae red, the last two segments of each tarsus black, thorax red with a thin covering of gray bloom, notum with black stripes separated by golden lines, wing largely hyaline, apex and interior of many of the cells clouded; abdomen uniformly red.

**Atomosia macquarti** Bellardi

1861. *Atomosia macquarti* Bellardi, Saggio, ii, 20.

One specimen from Cartago, February 6, 1909, agrees fairly well with the description of this species.

**Eumecosoma calverti** new species

Length 8 millimeters, body shining blue-black, wings uniformly pale brown, front and middle legs nearly entirely yellow, hind legs nearly all black.

Third segment of the antenna enlarged and with a very short, style-like process on its outer side near the apex, as in the other species of the genus, distinctly longer than the combined length of the other two segments which are nearly equal, front and face rather narrow, slightly widened above, vertex scooped out between the eyes and with a very prominent elevation which bears two long, curved bristles, whole space between the eyes golden pollinose; gibbosity small, near the oral margin and bearing only a few, mostly dark,

bristly hairs, beard sparse and pale yellowish, occiput dark with a few bristles. Dorsum of the thorax shining black, a small, pale yellow, pollinose spot on each humerus, sides of the thorax sparsely gray pollinose, the transverse row of bristles beneath the base of each wing pale yellow, halteres yellow, wing uniformly pale brown all over, veins nearly black; all the coxae black, more or less gray pollinose, front and middle legs mostly yellow, a stripe on the upper side of each femur and the apex of each tarsal segment black, hind legs mostly black, immediate base of each femur and each tibia yellow; legs furnished with sparse short hair and numerous long and slender bristles, some of which are black and some yellow.

*Holotype.*—Female, taken at Juan Viñas, Costa Rica, at an elevation of 3400 feet, September 28, 1909, by Dr. P. P. Calvert.

This genus has not been reported from North America heretofore, but five species have been described from Brazil, Peru and Bolivia. Dr. F. Herman of Erlangen gives an extensive treatise on the genus in Nova Acta Acad. C. L. C. G., band xcvi, page 70, (1912).

**Ommatius marginellus** Fabricius

1781. *Asilus marginellus* Fabricius, Spec. Ins. ii, 464.

A female specimen from Juan Viñas agrees in size and coloration with specimens of this species from New York and Ohio. I have no way of separating specimens which I have from New York, Ohio, Georgia, Mexico, Guatemala, Costa Rica and British Guiana. Former writers have reported the species from even a wider range than this—all the way from New England to Brazil, including the West Indies.

**Promachus cinctus** Bellardi

1861. *Promachus cinctus* Bellardi, Saggio, ii, 25.

There are three female specimens of *Promachus* in the collection. At least two are *cinctus*; Juan Viñas, June 28, 1909, near Rio Reventazon, 2500 ft. alt.; Forest on Florida road, west of Guapiles, June 3, 1909, but I am in doubt about the third, mainly on account of its much larger size. Aside from size the hair on various parts of the body is lighter, although the latter is of no uncommon occurrence in various species of Asilidae. The known range of *Promachus cinctus* is from San Lorenzo, Mexico to Trinidad and Costa Rica.

**Eicherax nigripes** Bellardi

1861. *Erax nigripes* Bellardi, Saggio, ii, 46.

In Linnaea Entomologica, band iii (1860), page 396, Loew de-

scribed the genus *Eristicus* without mentioning any species. Some years later he stated that species of this genus are found in America. In 1878, Osten Sacken showed that what we now know as *Erax maculatus* is the type of *Eristicus* and changed the name to *Neoeristicus*, because Wesmael had proposed the former as a generic name in another connection in 1844. In 1861, Bellardi described *nigripes* and *villosus* and placed them in *Eristicus*, but *villosus* is known now to be the same as *Erax maculatus* and Dr. Kertesz includes this in the genus *Erax* in his recent catalogue. In 1857, Bigot proposed *Eicherax* as a generic name, and mentioned as the type species *Erax simplex* from South America. A study of numerous specimens of what Bellardi called *Eristicus nigripes* shows that the species belongs to *Eicherax* rather than to *Neoeristicus*, on account of the venation; thus the latter is left without any species, in which case there is no use to retain it.

There are before me more than a dozen specimens of what I call *Eicherax nigripes*, ranging from Cordoba, Mexico to San Sebastiano, Brazil, including two from San Domingo, Costa Rica and several from Bartica, British Guiana.

Since Bellardi described the species Schiner is the only one whom I know to have mentioned additional specimens. In his Novara Reise, he mentions having a pair from South America and suggests changing the name to *bellardii*, because *nigripes* was preoccupied in the genus *Erax*. The species cannot be included in the genus *Erax* because of the venation and other characters, consequently *nigripes* still stands.

Whole body and legs black in ground color, wings uniformly pale brown, venation as in *Asilus*. Length, 12 to 15 millimeters.

Gibbosity of the face prominent, mystax composed of black bristles above and white ones below, beard white and fine, antennae, palpi and proboscis black, front and face rather wide, covered with pale yellow pollen, sides nearly parallel, bristles of the upper part of the occiput black; disk of the thorax with a wide black stripe, which is narrowly divided longitudinally at the middle by a fine gray line, sides of the thorax, including the coxae and most of the scutellum, yellow pollinose; legs black with black bristles, front and hind tibiae and tarsi with golden pile on inner side; wings uniformly pale brown, furcation of the third vein opposite the apex of the discal cell, no appendage, posterior branch of the third vein turns back to meet the costa far beyond the tip of the wing as in *Asilus*. Abdomen black with silvery white distributed as follows: two transverse spots on dorsal margin of the first segment, posterior margins of second and third segments except venter and a rather narrow

interruption on mid-dorsal line, very narrow hind margin of sixth segment and basal three-fourths of the seventh in the female or all of the seventh in the male. These silvery markings have a tendency to vary somewhat but the ones mentioned are fairly constant. In some of the males before me, however, the venter of the abdomen is quite largely silvery.

The structure of the female suggests *Asilus* very much, but the male has genitalia quite like males of the genus *Erax*. The oviduct in the female is conical much as in *Asilus sericeus*.

# A CONTRIBUTION TO THE KNOWLEDGE OF THE DERMAPTERA OF PANAMA[1]

BY MORGAN HEBARD

In recent years extensive collecting in Panama has been undertaken and the exceptionally fine series of Dermaptera thereby assembled is here considered. Nearly the entire collections were made by E. A. Schwarz and A. Busck for the National Museum; a few specimens taken by J. Zetek, for that institution, and by D. E. Harrower and the author, for the Hebard Collection, are also included. A general study of the American Dermaptera available has been undertaken, the results of which work are in the course of publication.[2] Considerable revision has been found necessary and in the present paper many, now obvious, mistakes are rectified in the Spongiphorinae, Labiinae and Sparattinae.

In the present paper twenty-two genera and twenty-nine species are recorded, of which five genera and six species are described as new. The only species previously recorded from Panama, but not represented in the present series, is *Echinopsalis thoracica* (Serville). A series of one hundred and eighty-five specimens has been considered.

Our thanks are due to Mr. A. N. Caudell for the privilege of studying the material belonging to the National Museum and the retention in the Hebard Collection of duplicate material.

It is important to note that "length of body" in the present paper signifies the distance from the buccal region of the head to the apex of the penultimate ventral abdominal segment, the head in normal position being carried horizontally.

[1] The second and succeeding papers of this series will deal with the Orthoptera of Panama.

[2] The first paper has already appeared, "Notes on the Earwigs (Dermaptera) of North America, north of the Mexican Boundary," Ent. News, xxviii, pp. 311–323, (1917). The others will treat of the Dermaptera of Mexico; General Notes; of the Dermaptera of the West Indies excluding Porto Rico, and of the Dermaptera of Porto Rico.

A portion of the material here considered, with a few other specimens belonging to the National Museum, has recently been recorded by Burr (Can. Ent. xlvi, pp. 273 to 276, (1914)). We are at a loss to account for the determinations as given by that author, unless the names were hastily jotted down and the material returned without careful study. We have considered the series with the greatest care and have studied all of the literature bearing on the species here recorded, as well as their allies. The results are convincing that Burr has made the following misidentifications:

| Material here recorded | According to Burr |
|---|---|
| *Euborellia antoni* | *Eulabis saramaccensis* |
| *Vostox brunneipennis* | *Vostox insignis* (part) |
| *Prosparatta humilis* | *Vostox insignis* (part) |
| *Prosparatta incerta* | *Purex parvicollis* |
| *Microvostox bilineatus* (part) | *Spongovostox ghilianii* ? |
| *Labia micans* | *Labia equatoria* |
| *Labia arcuata* | *Prolabia annulata* (part) |
| *Labia dorsalis* | *Prolabia annulata* (part) |
| *Barygerax esau* | *Prolabia formica* (part) |
| *Eugerax poecilum* | *Prolabia formica* (part) |

We have not seen the specimens recorded as *Vostox similis*, *Sparatta nigrina* and *Ancistrogaster variegata*. The determinations are questionable.

## DERMAPTERA

### Pygidicranidae

#### diplatyinae

**Diplatys gracilis** (Stål)

1855. *C[ylindrogaster] gracilis* Stål, Ofv. Kong. Vet.-Akad. Förh., xii, p. 350. [Rio [de] Janeiro, [Brazil].]

Porto Bello, Panama, II, 20, 1911, (Schwarz), 1 ♀.

**Diplatys jansoni** (Kirby)

1891. *Cylindrogaster jansoni* Kirby, Jour. Linn. Soc. London, Zool., xxiii, p. 507. [Chontales, Nicaragua.]

Paraiso, Canal Zone, Panama, II, 9 to V, 10, 1911, (Schwarz), 1 ♂, 3 ♀, 1 juv.

PYGIDICRANINAE

**Pyragra fuscata** Serville

1831. *Pyragra fuscata* Serville, Ann. Sci. Nat., xxii, p. 34. [French Guiana.]

Trinidad River, Panama, III, 23, 1912, V, 5, 1911, (Busck), 1 ♀, 2 juv.

Cabima, Pan., V, 21 to 28, 1911, (Busck), 6 ♀, 5 juv.

Chilibre River, Pan., IV, 14, 1911, (Busck), 6 juv.

Alhajuelo, Pan., IV, 7 and 17, 1911, (Busck), 11 juv.

The adults in this series all have the proximo-lateral portion of the tegmina, to near the costal margin, and the exposed portion of the wings, uniform warm buff. Such paler coloration is only shown as a narrow sutural border of the exposed portion of the wings in adults before us from Costa Rica. Similar presence or absence of pale tegminal markings is found in *Vostox brunneipennis*. Over certain regions but one color condition would appear to occur, though in restricted areas a multiplicity of color differences are sometimes found, thus indicating the valueless character of such differences even for racial distinction.

**Echinopsalis guttata** Bormans

1893. *Echinopsalis guttata* Bormans, Biol. Cent.-Amer., Orth., i, p. 3, pl. I, fig. 4. [Chontales, Nicaragua.]

Paraiso, Canal Zone, Panama, (P. B. Preston), 1 ♀, [U.S.N.M.]; I, 17, 1911, (Schwarz), 1 juv.

Porto Bello, Pan., II, 25, 1911, (Schwarz), 1 juv.

In the immature specimens the metazona of the pronotum, caudal margin of the metanotum and the proximal abdominal segments are pale.

LABIDURIDAE

PSALINAE

**Psalis americana** (Beauvois)

1817. *Forficula americana* Beauvois, Ins. rec. Afr. Amér., p. 165, Orth. pl. xiv, fig. 1. [San Domingo.]

Gatun, Canal Zone, Panama, VII, 19 to VIII, 5, 1916, (Harrower), 2 ♀, 5 juv. ♀.

Alhajuelo, Pan., IV, 4 and 17, 1911, (Busck), 1 ♂, 1 juv.

Porto Bello, Pan., II, 17 to III, 2, 1911, 1912, (Busck), 2 ♂, 6 ♀, 26 juv.

Trinidad River, Pan., V, 1 to VI, 1911, 1912, (Busck), 1 ♂, 3 ♀.
Cabima, Pan., V, 18 to 26, 1911, (Busck), 3 adults, 2 juv.
Chilibre River, Pan., IV, 14, 1911, (Busck), 1 juv.

*Measurements (in millimeters) of extremes*

| Porto Bello, Panama | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| ♂ (2) ..... | 16.5–32.8 | 2.6–3.4 | 2.4–3.3 | 5.1–7.6 | 4.7–6.6 |
| ♀ (6) ..... | 26.8–35.7 | 3.2–4.2 | 3.1–3.7 | 7.8–7.9 | 5.9–7 |

The adults, which have wings present, have the tegmina showing a broad mesal band of xanthine orange (greatest width 4.1 mm.). This band is, however, not as wide as in a similar pair before us from San Carlos, Costa Rica, in the Academy Collection.

The immature examples in the Hebard Collection are small (length 9.4 to 14.3 mm.) and very different from adults in general appearance. In the smallest, the twelfth or thirteenth antennal joint is very pale, in the larger specimens, slightly paler than the other joints, while the femora and sometimes the tibiae are suffused with blackish brown. As a result, confusion of these instars with *Euborellia annulipes* would be easy, were the heavier structure, proportionately larger head, longer distal antennal joints, lateral folds of proximal dorsal abdominal segments[3] and the second tarsal joints, which are distinctly shorter than in individuals of *Euborellia* of like size, not noted.

**Euborellia antoni** (Dohrn)

1864. *F[orcinella] antoni* Dohrn, Stett. Ent. Zeit., xxv, p. 289. [Venezuela.]

Frijoles, Canal Zone, Panama, (Schwarz), 1 ♂.
Paraiso, C. Z., Pan., I, 10, 1911, (Schwarz), 1 juv. ♀; V, 3, 1911, (Schwarz), 1 ♂, 1 ♀.
Corozal, C. Z., Pan., XI, 17, 1911, (Hebard), 1 ♀.

Females will be compared with that sex of *E. annulipes* in a forthcoming paper. The males of *antoni* are separable from males of *annulipes* by the decidedly larger size; head with margins of cheeks almost straight, parallel, to the broadly rounded latero-caudal angles; more sharply acute and more strongly keeled latero-caudal angles of the distal dorsal abdominal segments,

[3] Rehn has carefully described two of the later instars of the present species. Proc. Acad. Nat. Sci. Phila., 1903, pp. 301 to 303, (1903).

and femora with dark suffusions occupying nearly their entire cephalic and caudal faces.

Immature examples of this species might easily be mistaken for adult, or nearly adult, examples of *annulipes*.

LABIDURINAE

**Labidura riparia** (Pallas)

1773. *Forficula riparia* Pallas, Reise, Russ. Reichs., pt. ii, p. 727. [Shores of Irtysch River, western Siberia.]

Panama City, Canal Zone, Panama, XII, 1913, (J. Zetek), 2 ♀, [U. S. N. M.].

BRACHYLABINAE

**Leptisolabis howardi** Burr

1910. [*Leptisolabis*] *howardi* Burr, Proc. U. S. Nat. Mus., xxxviii, p. 449. [Cacao, Trece Aguas, Guatemala.]

Boquete, Panama, III, 1914, (J. Zetek), 1 ♀.

This specimen agrees fully with the type in ambisexual features. Length of body, 8.5; of forceps, 1.75 mm.

## Labiidae

SPONGIPHORINAE

Many difficulties have been encountered in the present group, and, in order to correct these as far as the material here treated is concerned, we feel obliged to present the following key. The Sparattinae are here briefly diagnosed, as one of the genera there included until now, is found to be really a member of the Spongiphorinae, showing nearest relationship to *Spongovostox* s.s.

A.[4] Attenuation at pronotum and base of abdomen not striking. Entire dorsal surface not subdeplanate. Coloration not brilliant or strongly contrasting.

B. Eyes large, their length considerably greater than that of the cheeks. (Form weakly depressed. First tarsal joint longer than third. Pronotum subquadrate.)

C. Size large. Tarsal joints heavy, with ventral surfaces heavily supplied with long hairs; first joint longer than combined length of second and third, second joint nearly as long as third. **Spongiphora** Serville

Genotype.—*croceipennis* Serville

[4] We are fortunate in having material of the genotypic species before us, of all of the genera here diagnosed, excepting *Purex*.

CC. Size medium. Tarsal joints slender, with ventral surfaces moderately supplied with shorter hairs; first joint about as long as combined length of second and third, second joint very much shorter than third.

**Vostox** Burr

Genotype.—*brunneipennis* (Serville)

BB. Eyes, small, their length distinctly less or nearly equalling that of the cheeks, never, however, less than half that of the cheeks.

C. Form weakly depressed. First tarsal joint longer than third. Pronotum subquadrate.

D. Tarsal joints heavy, with ventral surfaces heavily supplied with long hairs.

**Purex** Burr

Genotype.—*frontalis* (Dohrn)

DD. Tarsal joints slender, with ventral surfaces moderately supplied with shorter hairs.

E. Size medium. Cephalic sutures distinct. Occiput flattened. General facies very similar to the type of *Spongiphora*.

**Spongovostox** Burr

Genotype.—*quadrimaculata* (Stål)

EE. Size small to minute. Cephalic sutures subobsolete. Occiput weakly convex.[5] (Fourth antennal joint very slightly more than half as long as third.)

**Microvostox** new genus

Genotype.—*alter* (Burr)

CC. Form rather strongly depressed. First tarsal joint slightly shorter than, or equal in length to, third. Pronotum distinctly longer than wide. (Size medium. General facies very similar to the type of *Spongiphora*.)

**Prosparatta** Burr

Genotype.—*incerta* (Borelli)

AA. Attenuation at pronotum and base of abdomen striking. Entire dorsal surface subdeplanate. Coloration brilliant and strongly contrasting. (Eyes very small, their length considerably less than one-half that of the cheeks.)

**Sparattinae**

**Spongiphora croceipennis** Serville.

1831. *Spongiphora croceipennis* Serville, Ann. Sci. Nat., xxii, p. 31. [Brazil.]

Cabima, Panama, V, 24 and 29, 1911, (Busck), 1 ♂, 1 ♀.
La Chorrera, Pan., V, 17, 1912, (A. Busck), 1 ♂.

[5] Though the general facies of the species assigned to this genus show unmistakably a Spongiphorine ancestry, the less deplanate head with sutures subobsolete has caused much confusion with the genus *Labia*. From the forms properly referable to that genus, those of the present can, indeed, only be separated by the different general facies and shorter fourth antennal joint. In *Microvostox* this joint is only slightly more than half as long as the third; in *Labia* it is as long as, or very little shorter than, the third.

These specimens are small for the species, the length, including the forceps, of the males is 19 and 22.2 mm. The male specimen from La Chorrera lacks the disto-internal tooth of the forceps.

**Vostox brunneipennis** (Serville)

1839. *Psalidophora brunneipennis* Serville, Hist. Nat. Ins., Orth., p. 30. [Philadelphia, Pennsylvania.]

1855. *P[salidophora] insignis* Stål, Ofv. Kong. Vet.-Akad. Förh., xii, p. 349. [Antioquia, Colombia.]

1904. *Spongiphora geayi* Burr, Trans. Ent. Soc. London, 1904, p. 295. [Darien [Panama]. ]

1906. *Labia insularis* Bruner, Jour. N. Y. Ent. Soc., xiv, p. 137. [Trinidad.]

Paraiso, Canal Zone, Panama, III, 20, 1911, (Schwarz), 1 ♀.

Tabernilla, C. Z., Pan., V, 14, 1907, (Busck), 1 ♂.

After careful study of the literature and comparison of the type of *insularis*, and the individuals here recorded, with a large series of *brunneipennis* from the United States, we are convinced that *insignis* of Stål and *insularis* of Bruner are absolute synonyms of that species. Under *insignis* Burr has already placed his *geayi*, the original description of which exactly fits the male here recorded, except that the present specimen is smaller, with slightly more elongate forceps.

The individuals here recorded are smaller than any before us from the United States, but in that large series, far greater extremes in size are found than between the smallest specimens and those here considered. It is of importance to note that in the males of this insect, the degree of acuteness of the four pygidial projections, and the degree of production of the meso-distal portion of this appendage, frequently shows considerable variation. The pygidium of the male here recorded agrees fully with that of some of the males from the United States; in that series, however, the meso-distal portion is normally distinctly more produced.

The pale proximo-lateral marking of the tegmina is clearly of no specific or racial value. This marking is moderately distinct in the male here recorded, very weakly defined in the female type of Bruner's synonymous *insularis*, from Trinidad, but absent in the female from Panama. The tegmina of a Costa Rican specimen before us and of those from the United States are immaculate.[6]

[6] See discussion of such markings under *Pyragra fuscata* on page 303.

The present male has the forceps with sinistral arm more slender and shorter than the dextral, the dextral alone supplied at end of proximal third with a small inner tooth. The present specimens show the following measurements: length of body, ♂, 9.2, ♀, 7.7; of forceps, ♂, 3.4, ♀, 2.7 mm.

**Prosparatta humilis** new species (Text fig. 1; plate XXVI, figs. 1 and 2.)

This species shows a very strong general superficial resemblance to small examples of *Vostox brunneipennis*. Compared with the genotype, *P. incerta* (Borelli), the present species is found to be less slender, with less elongate pronotum, more acute male pygidium, male forceps with internal tooth more proximal and female forceps with distal flange of ventro-internal margin weaker and not abruptly terminated.

*Type.*—♂; Cabima, Panama. May 25, 1911. (A. Busck.) [U. S. National Museum.]

Size medium large for genus, form moderately depressed. Head with occiput impressed, cheeks longer than eyes. Antennae with first segment large, broadening in mesal third so that the distal portion is the more ample; second minute; third as long as first, but much more slender; fourth decidedly shorter, twice as long as its mesal width; succeeding segments increasing regularly in length distad. Pronotum longer than broad, smooth, with a medio-longitudinal linear sulcus very feebly indicated; rectangulate cephalad, broadly convex truncate caudad, lateral margins straight, showing an almost imperceptible divergence caudad; prozona tumid, this becoming very weak caudad in the middle of each side; metazona deplanate. Tegmina smooth, with distal margin truncate; wings with exposed area nearly half as long as tegmen. Abdomen with fourth and fifth dorsal segments showing laterad a weak, rounded carina; abdominal surface polished, but with surface microscopically very closely ruguloso-punctulate, excepting ultimate dorsal segment which is smooth, with length equal to half its width, showing a weak triangular depression meso-distad and with transverse distal margin thickened, feebly concave mesad and laterad. Pygidium small, about as wide as long, surface proximad very narrowly deplanate, the caudal margin of this area broadly convex, remaining surface transversely strongly

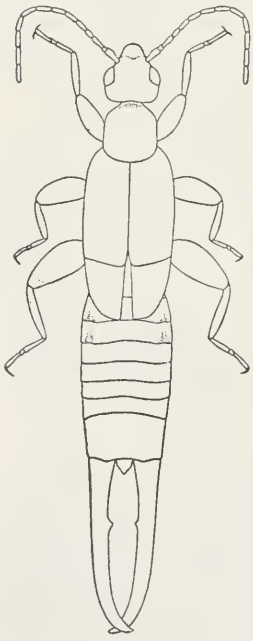

Fig. 1. *Prosparatta humilis* new species. Dorsal view of type. ♂. (× 5.7)

convex; lateral margins in proximal two-thirds weakly convergent, in distal third strongly convergent and very feebly concave to the immediate apex, which is very narrowly truncate. Forceps elongate, parallel to their apices which are incurved, bearing at distal extremity of proximal two-fifths a delicate internal tooth, the shaft, from that point distad, more decidedly flattened horizontally than proximad. Penultimate ventral abdominal segment ample, exposed portion about twice as broad as long, with latero-caudal angles broadly rounded and distal margin transverse, fringed with closely set microscopic hairs; preceding segment about two-thirds as wide.

*Allotype.*— ♀ ; same data as type. [U. S. National Museum.]

Agrees with type except in the following features. Size very slightly smaller. Distal portion of abdomen narrower. Pygidium small, simple, triangular with apex rounded. Forceps more nearly approximated, shorter, without tooth as in male, but armed at base with a projection which is broader than long, the distal margin of which is feebly angulato-concave. Shaft of forceps very feebly curved, not straight as in *incerta*, its ventro-internal margin roughly and weakly irregular, distad with a flange even more weakly indicated than in *incerta* and, unlike that species, disappearing evenly into the margin of the distal curvature. Disto-ventral abdominal segment with distal margin evenly convex.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|
| Cabima, *type* | 9.6 | 1.6 | 2.8 | 4.2 |
| Cabima, *paratype* | 10 | 1.7 | 2.8 | 4 |
| Lion Hill, *paratype* | 9.6 | 1.7 | 2.9 | 4.5 |
| ♀ | | | | |
| Cabima, *allotype* | 9.2 | 1.7 | 2.6 | 2.8 |
| Cabima, *paratype* | 10 | 1.7 | 2.7 | 2.9 |
| Cabima, *paratype* | 9.5 | 1.7 | 2.6 | 3 |
| Paraiso, *paratype* | 9.3 | 1.6 | 2.6 | 2.8 |

*Coloration.*—Entire insect glabrous. Head, pronotum and tegmina uniform, dark chestnut brown. Antennae with proximal joint buckthorn brown, other portions darker, prout's brown. Exposed portion of wings antimony yellow, suffused, particularly along the sutural margins, with dark chestnut brown. Abdomen dark chestnut brown, shading to rich chestnut in distal portion. Forceps rich chestnut. Femora buckthorn brown, suffused with prout's brown along the dorsal margins. Tibiae and tarsi prout's brown.

The series before us shows little structural, size or color variation. As in all the allied species, decided variation is to be expected, when larger series are at hand.

*Specimens Examined:* 10; 3 males, 4 females and 3 immature examples.

Cabima, Panama, V, 22 to 28, 1911, (Busck), 2 ♂, 3 ♀, *type, allotype, paratypes,* 3 juv.

Lion Hill, Canal Zone, Pan., VI, 18, 1907, (Busck), 1 ♂, *paratype.*

Paraiso, C. Z., Pan., II, 8, 1911, (Busck), 1 ♀, *paratype.*

**Prosparatta incerta** (Borelli)

1905. *Sparatta incerta* Borelli, Boll. Mus. Zool. Anat. comp. Torino, xx, no. 516, p. 11, figs. [Puerto Bertoni, Paraguay.]

Porto Bello, Panama, II, 25, 1911, (Schwarz), 1 ♀.

The series recently recorded by Rehn from the Madeira River[7] is before us. In addition, we have two males from La Guayra, Venezuela, taken July 2 to August 10, 1910, by W. Robinson. These latter show great size variation; length, including forceps, 11.5 and 15.5 mm.; and are much paler than the others, head, pronotum and tegmina auburn, dorsal surface of abdomen sanford's brown.

The specimen from Panama shows no difference of diagnostic value from this series. Its size is remarkably small; length, including forceps, 8 mm.; while the head and prozona are very pale hazel. It is evident from this material that the present is a very plastic species.

All of the females before us have the forceps showing the characteristic proximal truncate projection, with shaft straight to the incurved apex, its ventro-internal margin roughly and weakly irregular, subserrate, distad showing a feeble flange which terminates suddenly but roundly at the base of the distal curvature.

**MICROVOSTOX** new genus

Difficulty has been experienced in separating from *Labia* the smaller of the species of the Spongiphorinae, which have been referred to *Spongiphora* and more recently to *Spongovostox.* The present genus is difficult to define properly, but we agree with Borelli[8] and Burr[9] in deciding that certain species must be removed from *Labia,* though we feel that they show sufficiently great differences from *Spongovostox* to prevent their being assigned to that genus.

[7] Trans. Am. Ent. Soc., xlii, p. 221, (1916).

[8] Boll. Mus. Zool. Anat. comp. Univ. Torino, xx, no. 516, p. 8, (1905).

[9] Ann. k.-k. Naturhist. Hofmus. Wien, xxvi, p. 334, (1912).

The species of the present genus differ from those of *Labia* in having a distinctly Spongiphorine facies and in having the fourth antennal joint decidedly shorter than the third.[10]

*Genotype.—Microvostox alter* [*Spongovostox alter*] (Burr).[11]

In linear arrangement, *Microvostox* is found to follow *Spongovostox*, preceding *Prosparatta*, which is the last of the known genera of the Spongiphorinae.

*Generic Description.* Size small to minute; form weakly depressed, hardly more so than in many species of *Labia*. Head with sutures subobsolete, occiput weakly convex. Eyes small, their length appreciably less than that of the cheeks. Antennae with first joint moderately stout, nearly as long as combined length of second and third joints; second minute; third elongate and slender; fourth only slightly more than half as long as third, but (two times) longer than broad; succeeding joints more elongate in increasing ratio distad, cylindrical. Pronotum subquadrate; prozona weakly convex, metazona deplanate, except narrowly mesad, where a slight convexity is indicated. Abdomen with fourth and fifth dorsal segments showing on each side a weak, rounded, lateral carina. Penultimate ventral abdominal segment of male subrectangulate; preceding segment much wider than other more proximal segments. Tarsi with ventral surfaces supplied with short hairs. First tarsal joint as long as combined length of second and third joints; second joint very small.

In addition to the species recorded below, a male specimen of *P*[*salidophora*] *pygmaea* Dohrn, from Madeira-Marmoré R. R. Company Camp 41, Rio Madeira, Brazil, shows the species to be a member of the present genus.

It is highly probable that all of the small tropical American Spongiphorines discussed by Burr,[12] as well as *Labia mexicana* Bormans, *Labia tricolor* Kirby and *Labia schwarzi* Caudell, are members of the present genus.

[10] In *minor* (Linnaeus), genotype of *Labia*, the fourth antennal joint is as long as the third, in other species of the genus somewhat shorter, but never decidedly shorter.

[11] Ann. k.-k. Naturhist. Hofmus. Wien, xxvi, p. 336, (1912).

[12] Ann. k.-k. Naturhist. Hofmus. Wien, xxvi, p. 337, (1912).

**Microvostox alter** (Burr)

1912. *Spongovostox alter* Burr, Ann. k.-k. Naturhist. Hofmus. Wien, xxvi, p. 336. [Maripi, Bolivia (type); Minas Geraes, [Brazil]; Bugaba, Panama.]

Paraiso, Canal Zone, Panama, II, 9 and IV, 25, 1911, (Schwarz), 1 ♂, 1 ♀.

Alhajuelo, Pan., IV, 6, 1911, (Busck), 1 ♂.

This beautiful but minute insect is the smallest of the species of the Spongiphorinae.

**Microvostox bilineatus** (Scudder) (Plate XXVI, Fig. 5.)

1869. *Labia bilineata* Scudder, Proc. Bost. Soc. Nat. Hist., xii, p. 345. [Between Quito and Napo [Ecuador].]

Paraiso, Canal Zone, Panama, II, 1 to III, 5, 1911, (Schwarz; Busck), 2 ♀, 1 juv.

Bohio, C. Z., Pan., II, 7, 1911, (Schwarz), 1 juv.

Tabernilla, C. Z., Pan., (Busck), 1 ♀.

Ancon, C. Z., Pan., I, 12, 1911, (Busck), 1 ♂.

These specimens agree fully in all diagnostic features with the female type of this species, now before us. The females from Paraiso have the pronotum unicolorous; the other adults agree with the type in having the lateral portions of the metazona slightly paler.

LABIINAE

We find, with regret, that the removal of a number of species from the genus *Labia* to the genus *Microvostox*, a member of the Spongiphorinae, by no means clears up the difficulties encountered, in the material before us, representing other species of the present subfamily.

Were sufficient material at hand, careful revision of the American forms would clear away the present confusion. As no one is at present able to undertake this task, we have felt it our duty, after careful consideration of the literature, to diagnose and assign to their proper station only those species represented in the material before us. It is with much regret that we are obliged to state that, though Burr has correctly separated *Prolabia* from *Labia*, his efforts in the General Insectorum to assign many American species to one of these two genera, have resulted in a very unsatisfactory state of affairs. In the Annulata and Dorsalis Groups of the genus *Labia*, we take exception to other con-

clusions which Burr has reached, discussing these in the present paper under that heading.

## The Championi Group of the Genus Labia

The species of the present group are slender and very small, the males having the forceps unarmed, weakly angulate-arcuate, and the area embraced by them consequently elongate and roughly ovate. From the original descriptions we are able to associate *championi* Bormans, *tristani* Borelli and *equatoria* Burr, all closely related species. A fourth species is here described.

**Labia micans** new species (Text fig. 2; plate XXVI, figs. 3 and 4.)

The present species shows nearest relationship to *L. tristani*, differing in the smaller size, slightly different male forceps and male pygidium, which in that species differs in being ". . . quadrangolare, all'incirca largo quanto lungo, appiattito. . . ."

In *L. championi* decided differences are found in the unicolorous pronotum and very strongly transverse male pygidium.

The character of the antennal annulation is probably the same in all of these species, the distal joints being pale, their number varying individually. The presence or absence of wings which show beyond the tegmina, is evidently also a feature of individual difference[13] and not diagnostic, as was also supposed by Borelli.[14]

*Type*.—♂; Porto Bello, Panama. February 24, 1911. (A. Busck.) [U. S. National Museum.]

Size very small, form slender. Head smooth, shining, convex, with sutures indistinct. Eyes small, distinctly shorter than cheeks. Antennae (with twelve and thirteen joints); first segment large, as long as second and third together, expanding slightly near base, thence with sides parallel; second minute; third elongate; fourth three-quarters as long as third; fifth nearly as long as third; succeeding joints increasing slightly in length distad, ovate, the longest slightly more than twice as long as broad. Pronotum smooth, with a single bristle at each cephalic angle; length subequal to greatest (caudal) width; lateral margins feebly cingulate, nearly straight, very feebly diverging to the sharply rounded, nearly rectangulate caudal angles, caudal margin very feebly convex; median portion of surface weakly convex, triangular, with apex truncate at caudal margin of pronotum, remaining narrow lateral portions deplanate.

[13] See Burr, in considering *Prolabia unidentata*, Proc. U. S. Nat. Mus., xxxviii, p. 451, (1911). We fully agree with these observations, which are borne out by a single female, with wings well produced beyond the tegmina, in the present series of *micans*.

[14] Boll. Mus. Zool. Anat. comp. Univ. Torino, xxi, no. 531, p. 9, (1906).

Tegmina nearly twice as long as pronotum, smooth, shining, hairless, truncate distad in full expanse of dorsal field. Wings concealed. Abdomen with dorsal surface polished, without hairs; sides in greater part parallel, carinae absent; disto-lateral portions of dorsal segments not produced, except of eighth segment which is broadly rounded; penultimate dorsal segment fully three times as wide as long, with distal margin smooth. Pygidium twice as long as mesal width, surface deplanate, nearly perpendicular in proximal third, there sharply curved, deplanate and horizontal in distal two-thirds; lateral margins straight and feebly converging to distal fifth, becoming weakly cingulate distad, straight, parallel, thickened and supplied with long, silky hairs in distal fifth; narrow distal margin roughly rectangulate-emarginate, with sides straight, disto-lateral angles sharply rounded. Forceps moderately hairy, with shaft showing external margin weakly convex, stout proximad with few, irregular denticulations opposite pygidium and dorsal surface briefly deplanate beyond the slight basal enlargement, thence tapering evenly to mesal point where it is cylindrical, thence flattening with a feeble flange developing internally and again gradually disappearing before the acute, weakly incurved apex. Penultimate ventral abdominal segment with distal margin notched mesad, so that the distal portion of the pygidium is visible from below. Limbs short, femora stout; first tarsal joint with ventral surface well supplied with hairs, in length equal to that of the minute second and elongate third joints combined.

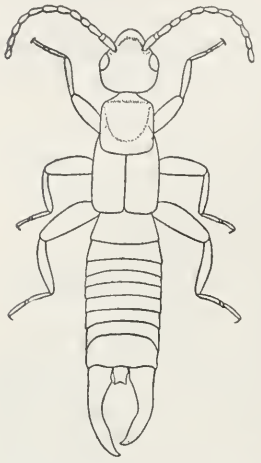

Fig. 2. *Labia micans* new species. Dorsal view of type. ♂. (× 11.5)

*Allotype.*— ♀ ; same data as type. [U. S. National Museum.]

Agrees with male except in the following features. Form more robust, the abdomen distinctly broader. Disto-dorsal abdominal segment more ample, surface triangularly weakly deplanate meso-distad, with caudal margin showing a series of well spaced, minute knobs, except on the brief lateral portions. Pygidium vertical, with surface deplanate, fitting tightly between the bases of the arms of the forceps. Forceps with numerous hairs dorso-proximad, very few minute, scattered hairs on other dorsal portions; shaft heavy, triquetrous, straight and evenly tapering to distal portion, where it is flattened, cylindrical, incurved to the sharp, sudden apex; ventro-internal margin, just beyond the base, produced in a moderate, percurrent flange, with its margin coarsely subserrate, in consequence the arms have their inner margins attingent throughout, except for a minute, triangular, proximal open space. Disto-ventral abdominal segment with distal margin obtuse-angulate but broadly rounded.

*Measurements (in millimeters)*[15]

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| Porto Bello, *type* | 4 | .65 | .68 | 1.02 | 1.09 |
| ♀ | | | | | |
| Porto Bello, *allotype* | 4.3 | .78 | .85 | 1.02 | .88 |
| Porto Bello, *paratype* | 4.5 | .68 | .75 | 1.29[16] | .95 |
| Cabima, *paratype* | 5 | .82 | .83 | 1.16 | 1.09 |

*Coloration.*—Head shining blackish brown. Antennae with proximal (eight or nine) joints pale mummy brown, distal (three or four) joints whitish. Pronotum shining, with slightly more than cephalic half ochraceous-orange, varying in series to ochraceous-tawny, remaining caudal portion black, varying in series to blackish chestnut. Tegmina shining, black, varying in series to blackish chestnut.[17] Abdomen with dorsal surface shining, blackish brown proximad shading to chestnut distad, in three specimens the chestnut extends over two-thirds of this surface. Forceps shining chestnut. Limbs immaculate ochraceous-buff.[18] Ventral surface of abdomen shining, varying from chestnut to russet.

*Specimens Examined:* 5; 1 male and 4 females.

Porto Bello, Panama, II, 20 to 25, 1911, (A. Busck), 1 ♂, 3 ♀, *type, allotype, paratypes,* (1 ♀ with fully developed wings).

Cabima, Pan., V, 24, 1911, (Busck), 1 ♀, *paratype.*

## The Species at Hand of the Curvicauda, Annulata and Dorsalis Groups of the Genus Labia

### *Key to males*

(Abdomen with numerous microscopic hairs and fewer longer hairs. Forceps strongly bowed; with hairs dorsad, particularly proximo-laterad.)

A. Forceps greatly widened proximad. Abdomen with dorsal segments neither produced or keeled laterad. (Pygidium declivent, disto-ventral margin straight, transverse. Tegmina and wings fully developed, thickly supplied with microscopic hairs. Forceps with lamellate internal margin of enlarged portion acute-angulate produced just beyond pygidium.)

**Labia curvicauda** (Motschulsky)

AA. Forceps not greatly widened proximad. Abdomen with some dorsal segments either produced or keeled laterad.

B. Abdomen with eighth and ninth dorsal segments produced and keeled laterad. Tegmina and wings (fully developed), thickly supplied with microscopic hairs.

[15] It has been found necessary to take the measurements of all the very small earwigs under a microscope.

[16] Wings fully developed, length of exposed portion .75 mm.

[17] Wings, in female with these organs fully developed, blackish chestnut, each with a large spot of ochraceous buff.

[18] In some specimens darker, due to discoloration in drying.

C. Forceps simple, without a tooth. Pygidium declivent; surface convex; much broader than long; distal margin concave, with disto-lateral angles bluntly rounded. Lateral productions and keels of eighth and ninth dorsal abdominal segments very weak.

**Labia annulata** (Fabricius)

CC. Forceps excavate in median internal portion, with a ventro-internal tooth. Pygidium declivent; surface subdeplanate; broader than long; disto-lateral angles sharply acute-angulate produced with intervening portion of distal margin transverse. Lateral productions and keels of eighth and ninth dorsal abdominal segments weak.

**Labia arcuata** Scudder

BB. Abdomen with fifth to ninth dorsal segments produced or keeled laterad. Tegmina and wings smooth, with very few microscopic hairs.

C. Tegmina and wings reduced. Abdomen with fifth to ninth dorsal segments moderately produced but not keeled laterad. Forceps simple, without a tooth. Pygidium declivent; surface subdeplanate; lateral margins rather decidedly concave convergent to the moderately broad and bluntly rounded disto-lateral portions, between which the distal margin is deeply and narrowly arcuato-concave.[19]

**Labia rotundata** Scudder

CC. Tegmina and wings fully developed. Abdomen with fifth to ninth dorsal segments strongly produced and keeled laterad, fourth segment moderately produced. Forceps simple, with a minute ventro-internal tooth at end of proximal third. Pygidium declivent; surface subdeplanate; lateral margins feebly convex convergent to minute disto-lateral knob-like projections, between which the rather narrow distal margin is transverse, feebly concave.

**Labia dorsalis** (Burmeister)

## *Key to females*

(Abdomen with numerous microscopic hairs and fewer longer hairs.)

A. Forceps simple, heavy, subtriquetrous, ventro-internal margins attingent. (Pygidium inset between bases of forceps. Tegmina and wings fully developed.)

B. Size minute. Tegmina and wings thickly supplied with microscopic hairs. Forceps with lamellate ventro-internal margin with smooth edge. Pygidium shield-shaped, with lateral margins convex convergent.

**Labia curvicauda** (Motschulsky)

BB. Size very small. Tegmina and wings smooth, with very few microscopic hairs. Forceps with lamellate ventro-internal margin with edge showing some blunt serrations. Pygidium bluntly triangular, with lateral margins straight convergent. **Labia dorsalis** (Burmeister)

AA. Forceps simple, slender, cylindrical, well separated. (Size very small.)

B. Tegmina and wings fully developed, thickly supplied with microscopic hairs.

[19] This is determined from a single male before us, with no definite data but apparently from Mexico, in the National Museum Collection.

C. Pygidium convex; about as long as broad; lateral margins with minute nodes, strongly convergent to acute-angulate produced and slightly divergent latero-caudal projections, which occupy the entire narrow distal margin. **Labia annulata** (Fabricius)

CC. Pygidium convex; distinctly shorter than broad; lateral margins smooth, subparallel, very feebly convergent to minute, acute latero-caudal projections, between which the broad distal margin is transverse. **Labia arcuata** Scudder

BB. Tegmina and wings reduced, smooth, with very few microscopic hairs. (Pygidium elongate, truncate-conical, considerably longer than wide; lateral margins smooth, moderately convergent to minute, acute, latero-caudal projections, between which the very narrow distal margin is transverse.)[20] **Labia rotundata** Scudder

## The Curvicauda Group

The single species of this group found in America is readily distinguished by the characters given in the preceding keys.[21]

**Labia curvicauda** (Motschulsky)

1863. *Forficelisa curvicauda* Motschulsky, Bull. Soc. Nat. Moscou, xxxvi, pt. ii, p. 2, pl. II, fig. 1. [Nura-Ellia Mountains, Ceylon.]

This cosmopolitan species, representing an Old World group, shows numerous distinctive differences from the members of the Annulata and Dorsalis Groups, to the species of which, however, it bears a general superficial similarity.

Paraiso, Canal Zone, Panama, I, 1 to IV, 25, 1911, (Schwarz), 1 ♂, 3 ♀.

Corozal, C. Z. Pan., XI, 17, 1913, (Hebard), 1 ♂.

## The Annulata Group

The present group includes the species *annulata*, *arcuata*, *conspicua*[22] and *rotundata*. From the literature, it does not ap-

[20] This is determined from the type, from Mexico, in the Museum of Comparative Zoology Collection, and two females from the National Museum, one from Orizaba, Vera Cruz, Mexico, the other without definite data but apparently from Mexico.

[21] Burr's failure to recognize or assign correctly the majority of the smaller forms of the American Labiinae is well demonstrated by his disposition of material of the present insect. He determined correctly material of both sexes from Long Key, Florida, in 1910, but that same year recorded from Cayamas, Cuba, a male as *Labia trinitatis* and females as *Labia unidentata*.

[22] A single specimen from Costa Rica before us, represents either this insect or a very closely related species. We have in hand series of the other species, including the unique types of *arcuata* (male) and *rotundata* (female).

pear probable that other species, referable to this group, have been described. Burr has placed under *annulata* all of the material which he had of both the Annulata and Dorsalis Groups,[23] not only locating *dorsalis*, *chalybea*, *arcuata* and *rotundata* in the synonymy under that name, but also *flaviscuta*. Such action can only be attributed to jumping at conclusions in a difficult group, with insufficient material at hand.

The weakly produced lateral angles of the male dorsal abdominal segments and simple, slender, well separated female forceps, readily separate individuals of the present group from those of the Dorsalis Group.

**Labia annulata** (Fabricius)

1793. [*Forficula*] *annulata* Fabricius, Ent. Syst., ii, p. 4. [Islands of meridional America.]

1838. *F*[*orficula*] *dorsalis* Burmeister, Handb. Ent., ii, abth. ii, pt. i, p. 754. [Colombia.]

Porto Bello, Panama, II, 25, to III, 6, 1911, (Busck; Schwarz), 1 ♂, 2 ♀.

Bohio, Canal Zone, Pan., II, 7, 1911, (Schwarz), 1 ♀.

Paraiso, C. Z., Pan., I, 14 to 25, 1911, (Schwarz), 1 ♂, 2 ♀.

The present insect agrees with the brief Fabrician description, from which Burmeister's description of *dorsalis* shows no diagnostic differences.

To the present minute species, nearest relationship is shown by *L. arcuata*, small and brilliantly colored examples of the latter species bearing to material of *annulata* a close superficial resemblance.

The following features of importance are noted in the series before us. Antennae with first segment equal to combined length of second, third and fourth; second quadrate; third only slightly longer than wide; fourth quadrate but larger than second; longest joint about three times as long as wide; joints dark to eleventh or twelfth, remaining joints pale. Pronotum, tegmina and wings shining black, metallic, showing a weakly bluish luster in some lights; pronotum sometimes paler, brownish, particularly laterad. Limbs with suffused annuli. Caudal metatarsus distinctly longer than combined length of second and

[23] Proc. U. S. Nat. Mus., xxxviii, p. 453, (1910).

third tarsal joints.[24] Female with dorsal abdominal segments neither produced or keeled laterad.[25]

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| Porto Bello | 3.7 | .61 | .61 | 1.02 | .8 |
| Paraiso | 3.8 | .62 | .61 | 1.16 | .77 |
| ♀ | | | | | |
| Porto Bello | 4.2 | .69 | .68 | 1.29 | .88 |
| Paraiso | 4 | .65 | .64 | 1.16 | .84 |

**Labia arcuata** Scudder

1876. *Labia arcuata* Scudder, Proc. Bost. Soc. Nat. Hist., xviii, p. 257. [Vassouras, 100 miles north of Rio [de Janeiro], Brazil.]

Tabernilla, Canal Zone, Panama, V, 1 to 14, 1907, (Busck), 1 ♂, 2 ♀.

Paraiso, C. Z., Pan., I, 28 to II, 2, 1911, (Schwarz; Busck), 3 ♂, 2 juv.

Old Panama, Pan., I, 31, 1911, (Busck), 2 ♂, 1 ♀.

In general coloration this species ranges from a solid blackish type, to a brown and black condition, similar to the normal coloration of *L. annulata*. The type of this species, a male, now before us, represents the former condition.

The following features of importance are noted in the series before us. Antennae with first segment equal to combined length of second and third; second quadrate; third elongate; fourth three-quarters as long as third; fifth nearly as long as third; succeeding joints elongate-ovate, the longest over four times as long as broad; proximal joints dark, one or two distal joints pale. Pronotum, tegmina and wings colored as in *annulata*, the metallic luster sometimes very weak. Limbs with annuli subobsolete.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| Tabernilla | 4.9 | .82 | .8 | 1.7 | 1.09 |
| Paraiso | 3.8 | .68 | .68 | 1.45 | .95 |
| Paraiso | 3.9 | .69 | .72 | 1.29 | .95 |
| Old Panama | 4.8 | .74 | .74 | 1.63 | 1.09 |
| Old Panama | 5 | .86 | .84 | 1.9 | 1.22 |
| Vassouras, Brazil, *type* | 6 | .88 | .84 | 1.97 | 1.43 |

[24] This is true of all of the species before us of the Curvicauda, Annulata and Dorsalis Groups.

[25] Likewise true of the three allied groups here considered.

Though the present series shows decided size and color variation, very little individual variation is found in hairy covering, lateral production of male dorsal abdominal segments or in the pygidium and forceps.

## The Dorsalis Group

The present group includes the species *dorsalis* and *cyanescens*.[26] Under the Annulata Group comparisons are made and the species discussed.

**Labia dorsalis** (Burmeister)

1838. *F[orficula] dorsalis* Burmeister, Handb. Ent., ii, abth. ii, pt. i, p. 754. [Colombia.]

1864. *L[abia] chalybea* Dohrn,[27] Stett. Ent. Zeit., xxv, p. 429. [Venezuela.]

1906. *Labia trinitatis* Bruner, Journ. N. Y. Ent. Soc., xiv, p. 136. [Trinidad.]

Cabima, Panama, V, 22, 1911, (Busck), 1 ♀.

Porto Bello, Pan., 1 ♂, 2 ♀.

As indicated in the last footnote, the name *chalybea* appears to be, at least in part, founded on material of the species previously described as *dorsalis*. Professor Bruner has very kindly sent us for examination the types of *trinitatis*, which agree in every structural feature with the Panamanian series assigned with little doubt to *dorsalis*.

The Panamanian male has the dorsal abdominal surface blackish with distal segment and forceps pale yellowish, the tegmina and wings strongly metallic; that from Trinidad has the dorsal surface of the abdomen and the forceps dark reddish brown as in the females before us, the tegmina and wings less strikingly metallic. The Mexican males are even more obscurely colored. Little definite can be said of this interesting species until much larger series are collected. It is clear that very great color variation occurs.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| Motzorongo, Mexico | 6.1 | .88 | .88 | 1.84 | 1.16 |
| Motzorongo, Mexico | 5.1 | .88 | .88 | 1.7 | 1.09 |

[26] As far as we are able to determine from the description of that species.

[27] The description does not fully agree and may have been compiled from examples of several species; the female with forceps "zusammenliegend" is almost assuredly the present species. Burr's discussion of the portion of the type series belonging to the Vienna Museum offers little assistance.

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| Porto Bello, Panama | 5.6 | .92 | .88 | 1.84 | 1.22 |
| Trinidad. *Type* of *trinitatis* | 5.5 | .86 | .86 | 1.9 | 1.22 |
| ♀ | | | | | |
| Porto Bello, Panama | 4.53 | .82 | .8 | 1.55 | 1.02 |
| Porto Bello, Panama | 4.35 | .82 | .8 | 1.84 | 1.16 |
| Trinidad. *Type* of *trinitatis* | 4.9 | .82 | .81 | 1.7 | 1.09 |

The following minute species are extremely hard to place, owing to the presence of various important features which do not agree with those of any one of the groups of the Dermaptera.

The structure of the head in all is as found in the Labiinae. The pronotum is suggestive of the Labiinae in *Geracodes* and *Barygerax*, of the Diplatyinae in *Gerax* and *Eugerax*. The tegminal and wing development is distinctive and different in all, and these organs are thickly covered with short hairs, except in *Gerax*. The abdomen in all is thickly clothed with hairs. The forceps are simple, cylindrical and straight, to the incurved apex in the males.[28] The tarsal claws, in all except *Geracodes*, are furnished with arolia, a feature not found in the Labiinae, but occurring in the Diplatyinae. The development of the male metaperameres is remarkable in *Gerax;* the spines, projecting beneath the forceps in *Eugerax*, unparalleled in the Dermaptera. The femora are unkeeled as in the Labiinae.

These species will probably require the erection of one or more new subfamilies, when sufficient material has been obtained to examine fully the genitalia in both sexes, and the relative values of the most striking differences are better understood. At present we are inclined to place them after the Labiinae.

The characters of greatest importance are given in the following key:

A. Tarsal claws without arolia. First antennal joint over twice as long as any of the distal joints. Wings extending beyond tegmina more than tegminal length. (Eye much shorter than cheek. Antennae with sixteen to seventeen joints; first antennal joint heavy and very elongate, widened proximad; succeeding joints all short, moniliform. Pronotum not strikingly narrower than head, lateral margins rather strongly diverging caudad, metazona deplanate. Tegmen elongate, about twice as long as pronotum. Head,

[28] The male sex of *Geracodes* is unknown.

pronotum, tegmina, wings, abdomen and forceps thickly supplied with short hairs, abdomen with few longer hairs. Male sex unknown.)

**Geracodes litus** new species

AA. Tarsal claws with arolia. First antennal joint distinctly less than twice as long as any of the distal joints. Wings extending beyond tegmina much less than tegminal length. (Male forceps simple.)

B. Antennae with third joint pyriform; succeeding joints short, flattened rectangulato-oval, moniliform. Pronotum not strikingly narrower than head, metazona deplanate. Male without armed metaperameres or projecting ventro-distal lateral spines. (Eye about as long as cheek. Antennae with fourteen to sixteen joints; first antennal joint heavy and rather elongate, widened mesad. Tegmen very elongate, nearly three times as long as pronotum. Head, tegmina, wings, abdomen and forceps very thickly supplied with short hairs; pronotum fringed laterad with some stouter hairs, which are elongate cephalad; abdomen and forceps with numerous longer hairs.

**Barygerax esau** new species

BB. Antennae with third joint subcylindrical; succeeding joints more elongate, not moniliform. Pronotum strikingly narrower than head, metazona decidedly ascending to lateral margins. Male with armed metaperameres or projecting ventro-distal lateral spines. (Antennae with eleven to thirteen joints [29]; fourth joint slightly shorter than third; succeeding joints increasing, then decreasing, in length. Wings moderately projecting beyond tegmina.)

C. Eye very large, over twice as long as the short cheek. Tegmen very elongate, nearly three times as long as pronotum. Head supplied with minute, microscopic hairs; pronotum smooth, with a single bristle at each cephalic angle; tegmina and wings smooth; abdomen and forceps thickly supplied with short hairs and with numerous longer hairs. Male without lateral aciculate projections beneath base of forceps. Metaperameres of male with two decurved, chitinous fangs. **Gerax phantasma** new species

CC. Eye small, distinctly shorter than cheek. Tegmen moderately elongate, slightly over twice as long as pronotum. Head, pronotum, tegmina, wings, abdomen and forceps thickly supplied with minute hairs, abdomen and forceps with numerous longer hairs. Male with an elongate, chitinous, aciculate process projecting caudad at the base of each arm of the forceps. Metaperameres of male without chitinous processes.

**Eugerax poecilum** new species

### GERACODES[30] new genus

Very distinctive in characters of the antennae and wings. Of a general Labiine facies and showing nearest agreement with *Labia minor*, differing from that species in: the much more elon-

[29] The antennae are incomplete, apparently clipped, in the type of *Gerax phantasma* and in the majority of the specimens of *Eugerax poecilum*. The general similarity leads us to believe that the number of joints will be found about the same in these species.

[30] From γέραχ and -οδες = resembling *Gerax*.

gate first antennal joint and much shorter succeeding joints; the narrower head, with more sharply truncate occiput; the more elongate pronotum, which is narrower cephalad, with lateral margins more divergent caudad; the much more elongate wings, and the much less flattened, more nearly conical forceps of the female.[31]

The genus is monotypic. *Genotype.—Geracodes litus* new species.

Features of generic value are given in the key. These we consider to be: the ocular and antennal characters; the general pronotal character; the greatly elongate wings and absence of arolia. In addition, we would remark that the caudal metatarsus is very slightly longer than the combined length of the second and third tarsal joints and has the ventral surface hairy, with two rows of widely spaced, elongate, chaetiform spines.

This genus would appear to be truly Labiine, but is apparently related to *Barygerax*, which, in turn, shares various characters with *Gerax* and *Eugerax*, which latter genera show a strongly Diplatyine development.

**Geracodes litus** new species (Plate XXVI, Figs. 6 and 7.)

This is a distinctive insect structurally; in general appearance resembling *Labia minor*, but differing widely from that species as shown above in the generic treatment.

*Type.*— ♀ ; La Chorrera, Panama. May 17, 1912. (A. Busck.) [U. S. National Museum.]

The features of major importance are given in the key and generic diagnosis. In addition we would remark the following. Form moderately slender. Head with margins of cheeks almost straight, slightly converging to the sharply rounded latero-caudal angles; caudal margin straight, truncate, cut by the distinct, medio-longitudinal, linear occipital suture. Pronotum with prozona convex and lateral margins cingulate. Tegmina with transverse distal margin rounding broadly into the sutural margin. Wings with an elongate-trigonal, proximal portion at the sutural margin, smooth and pallid; apex more broadly truncate than in *Labia minor*, the distal margin straight, transverse. Ultimate dorsal abdominal segment almost entirely concealed,[32] weakly produced mesad in two weakly convex portions, with caudal margin weakly bilobate. Pygidium minute. Forceps stout, length slightly over twice the greatest prox-

[31] The male sex is unknown and will probably show other distinctive features for *Geracodes*.

[32] The abdomen is distinctly retracted in the only specimen before us.

imal width; straight to the moderately incurved, chitinous, sharp apex; ventro-internal margin feebly lamellate to apex and very minutely and microscopically serrulate. Penultimate ventral abdominal segment with distal margin feebly convex.

Length of body, 4.5; of pronotum, .65; of tegmen, 1.29; of exposed portion of wing, 1.43; of forceps, .75: width of pronotum, cephalic, .5; of pronotum, caudal, .74; of tegmen, .61; of abdomen, 1.02 mm.

Head, and dorsal surface of abdomen, mesad, warm sepia. Antennae, pronotum, tegmina and wings bister, darkest on distal portion of wings. Forceps cinnamon brown. Femora clay color; underparts, tarsi and tibiae cinnamon-buff.

The type is unique.

**BARYGERAX**[33] new genus

This genus agrees with *Labia* and *Geracodes* in the head and pronotal contour. The presence of arolia, however, and simple male forceps, indicate much closer affinity to *Gerax* and *Eugerax;* though, in the present genus, the male has the metaperameres neither armed as in *Gerax,* or remarkable projecting, disto-ventral, lateral spines as in *Eugerax.*

The genus is monotypic. *Genotype.—Barygerax esau* new species.

Generic characters are given to the key. These are: the ocular and antennal characters, the general pronotal structure, the elongate tegmina and simple male forceps and metaperameres. In addition, we would note that the caudal metatarsus, though armed as in *Geracodes litus,* is considerably longer than the combined length of the second and third tarsal joints. The limbs are shorter and stouter than in the other species here considered.

This genus is anomalous; the head and pronotum indicating strong Labiine affinity, the forceps and arolia Diplatyine relationship.

**Barygerax esau** new species (Plate XXVI, figs. 8 and 9.)

This is a strikingly beautiful insect under the microscope, the contrasts of coloration being remarkable.

*Type.*—♂; Paraiso, Canal Zone, Panama. May 10, 1911. (E. A. Schwarz.) [U. S. National Museum.]

The features of major importance are discussed in the key and generic discussion. In addition, the following are noted. Form moderately robust. Head with margins of cheeks converging moderately strongly to the moderately

[33] From βαρύς = heavy, and *Gerax.*

rounded latero-caudal angles; caudal margin showing a very feeble, broad median concavity, occipital medio-longitudinal suture subobsolete. Antennal joints abruptly and strongly moniliform. Pronotum with prozona convex; lateral margins feebly diverging caudad, caudal margin weakly convex. Tegmina narrowing gradually distad; costal margin curving to the sutural margin, angle there sharply rounded. Wings with costal margin curving to the sharp angle at the straight sutural margin. Ultimate dorsal abdominal segment over twice as wide as long; surface evenly convex, except in medio-distal area where it is flattened; distal margin angularly produced, with apex blunt, above the dorsal ridge of each arm of the forceps, transverse between these projections. Pygidium not apparent. Forceps stout, straight and evenly tapering to the strongly incurved, acute apex; ventro-internal margins straight, subattingent, microscopically minutely serrulate to distal curvature; dorsal surface convex, with a brief but decided proximal medio-longitudinal ridge.[34] Penultimate ventral abdominal segment with distal margin feebly convex to a decided, though small, median, arcuato-angulate emargination.

Length of body, 4; of pronotum, .62; of tegmen, 1.66; of exposed portion of wing, .19; of forceps, .75: width of pronotum, cephalic, .62; of pronotum, caudal, .72; of tegmen, .59; of abdomen, 1.22 mm.

Head and ultimate dorsal abdominal segment blackish brown. Antennae clear tawny, the last segments alone slightly suffused. Cephalic limbs, median femora and tibiae, caudal femora and remaining portions of abdomen blackish chestnut brown; median tarsi and caudal tibiae paler, caudal tarsi buffy. Pronotum with prozona blackish brown, with a weak, bluish metallic luster; metazona clear light buff, suffused with brown proximo-mesad toward the prozona. Tegmina and wings blackish brown, with a decided metallic luster, green, blue or purple in different lights. Hairy covering of abdomen and forceps conspicuously golden in some lights.

The type is unique.

### **GERAX**[35] new genus

The present genus shows Labiine characters only in the simple head and femora. The pronotum, male forceps and presence of arolia all indicate Diplatyine affinity. The remarkable armament of the metaperameres of the male is distinctive.

The genus is related to *Eugerax*, but differs widely in the greatly developed eyes, with facets larger and each distinctly more convex, short cheeks, smooth pronotum and tegmina, wide differences in the male genitalic armament and much shorter caudal metatarsus and decidedly longer second caudal tarsal joint.

[34] This ridge may be very similar to that found in *Gerax* and *Eugerax*. In the single specimen before us the proximo-dorsal portion of the forceps is hidden by the ultimate dorsal abdominal segment.

[35] From γέραχ = a prize.

The genus is monotypic. *Genotype.—Gerax phantasma* new species.

Generic features are given in the key. These are: the ocular antennal characters, the general pronotal structure, character of hairy covering, simple male forceps and highly specialized male metaperameres. In addition, we would observe that the caudal metatarsus is supplied ventrad with hairs, but no chaetiform spines, agreeing in this character with *Eugerax*, it is distinctly longer than the combined length of the second and third tarsal joints; the second tarsal joint is exceptionally elongate, fully twice as long as its greatest width and over half as long as the short third joint. As in *Eugerax*, the limbs are elongate and slender.

The genus shows an unmistakably Diplatyine general facies.

**Gerax phantasma** new species (Plate XXVI, figs. 10 and 11.)

This minute insect is pale and immaculate; its slender form, large eyes, minute pronotum, ample tegmina and minute, simple forceps, give it a distinctive appearance.

*Type.*—♂; Trinidad River, Panama. March 17, 1912. (A. Busck.) [U. S. National Museum.]

The most important characters are given in the key and generic diagnosis. In addition, the following features are noted. Form very slender. Head with brief lateral margins of cheeks rounding broadly into the transverse caudal margin, this entire margin with a fringe of well spaced bristles; medio-longitudinal occipital suture distinct only toward caudal margin of head. Antennal joints not moniliform; first joint about equal to combined length of second and third joints, succeeding joints increasing in length distad.[36] Pronotum very small, smooth except for a single bristle at each latero-cephalic angle; prozona convex; metazona decidedly ascending laterad, feebly ascending caudad; lateral margins feebly diverging caudad, caudal margin strongly convex. Tegmina with surface smooth; evenly convex from sutural to costal margin beyond shoulders, narrowing only in distal third, where the costal margin is broadly convex to the rather sharply rounded angle at the sutural margin. Wings supplied with a few minute, scattered hairs; costal margin weakly convex to very brief, transverse, distal truncation. Ultimate dorsal abdominal segment much as in *Barygerax esau*, but with distal margin only feebly produced in a minute convexity above the dorsal ridge of each arm of the forceps. Pygidium minute, delicate, declivent, with straight lateral margins weakly converging to the broad, transverse, disto-ventral margin. Forceps moderately stout, more slender than in *B. esau*, straight and evenly tapering to the immediate, chitinous, aciculate, incurved apex; ventro-internal margins

[36] Nine and eleven joints remain, the antenna with the greatest number having apparently lost only one or two distal joints.

weakly lamellate, straight, subattingent, serrulate to the immediate apex and thickly supplied with erect, small, subequal hairs; dorsal surface convex, with a brief, but very decided, proximal ridge, which extends from near the internal margin to just beyond the median line of the shaft and is strongly convex in longitudinal contour; ventral surface deplanate. Metaperameres projecting, soft, but with two very sharp, chitinous, medio-distal, fang-like thorns, directed ventrad and curving cephalad, proximad of these the integument is subchitinous and produced in a convex ridge, which fits into the median emargination of the penultimate ventral abdominal segment.[37] This segment has its caudal margin transverse, with a small but decided angulate emargination mesad.

Length of body, 4.01; of pronotum, .57; of tegmen, 1.5; of exposed portion of wing, .35; of forceps, .57: width of pronotum, cephalic, .48; of pronotum, caudal, .54; of tegmen, .51; of abdomen, .68 mm.

Head ochraceous-tawny, eyes black. Antennae, pronotum and limbs ochraceous-buff. Tegmina and wings ochraceous-buff, the former washed with ochraceous-tawny proximad, the latter heavily washed with prout's brown along the costal margin. Abdomen ochraceous-tawny, shading to cinnamon brown mesad, with lateral portions of fourth and fifth dorsal segments washed with prout's brown. Forceps ochraceous-tawny. Hairy covering golden.

The type is unique.

**EUGERAX**[38] new genus

This genus agrees with *Gerax*, except in the features given in the comparison under the generic treatment of *Gerax*.

The genus is monotypic. *Genotype.—Eugerax poecilum* new species.

The generic features given in the key are: small eyes, general character of pronotum, character of hairy covering, simple and similar forceps in both sexes, and remarkable male genitalic armament. In addition, we would remark that the caudal metatarsus is supplied ventrad with hairs, but no chaetiform spines; it is remarkably elongate and slender, twice as long as the combined length of the minute second and short third joints. The limbs are elongate and slender.

The general facies is strongly Diplatyine; the head is, however, evenly convex in both sexes, with eyes small, and the femora are simple, not keeled. An immature example before us has the

[37] In this specimen the metaperameres are evidently extruded; it is not probable that the fangs, here described, can be drawn completely in and thus concealed.

[38] From εὖ = beautiful, and *Gerax*.

forceps as in the adult, not represented by segmented cerci as found in the early stages of the Diplatyinae.

**Eugerax poecilum** new species (Plate XXVI, figs. 12, 13, 14 and 15.)

The present beautiful species is the smallest of the known forms of the Dermaptera. Some similarity in general form and antennal coloration is shown to *Prolabia formica* (Burr), the male of that species showing, however, very wide differentiation in having the widely separated forceps bowed and unlike those of the opposite sex.

*Type.*—♂; Paraiso, Canal Zone, Panama. January 19, 1911. E. A. Schwarz.) [U. S. National Museum.]

The characters of greatest importance are given in the key and generic diagnosis. In addition, we would note the following. Form moderately slender. Head with surface thickly covered with microscopic hairs; lateral margins of cheeks distinctly convergent to the broadly rounded latero-caudal angles, caudal margin transverse; occipital sutures almost obsolete. Antennal joints not moniliform, (normally eleven to thirteen in series[39]); first joint equal to combined length of second and third joints; fourth slightly shorter than third; succeeding joints increasing, then decreasing, in length, longest about two and one-half times as long as wide. Pronotum very small, covered with microscopic hairs and with a few bristles along the lateral margins, caudal margin strongly convex; prozona convex; metazona strongly ascending laterad and caudad. Tegmina with surface thickly covered with minute hairs; evenly convex from sutural to costal margin beyond shoulders, broadest near apex where costal margin rounds broadly into the straight, transverse distal margin, which forms a sharply rounded right-angle with the sutural margin. Wings similarly hairy, with costal margin weakly convex to the moderate, transverse distal truncation. Ultimate dorsal abdominal segment much as in *Barygerax esau*. Pygidium not apparent. Forceps much as in *Gerax phantasma*, but slightly shorter, with shaft moderately upcurved. (Metaperameres projecting, soft, unarmed.) Beneath each arm of the forceps a nearly straight, elongate, chitinous, aciculate process projects caudad. Penultimate ventral abdominal segment with distal margin moderately convex laterad, thus forming a shallowly angulate emargination mesad.

*Allotype.*—♀; same data as type, but taken February 6, 1911. [U. S. National Museum.]

This sex agrees with the male to an exceptional degree. The only noticeable differences are that the size is very slightly larger; the form is slightly more robust; the ventro-internal margins of the forceps are smooth; the aciculate projections beneath the forceps are absent, and the number of ventral abdominal segments (not including the penultimate segment), as is found throughout the Dermaptera, are five in the female, seven in the male.

[39] See page 322, footnote 29.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| Paraiso, *type* | 3.13 | .42 | .46 | .92 | .41 |
| Paraiso, *paratypes* (3) | 2.5–3.13 | .4–.43 | .44–.48 | .9–.95 | .41–.45 |
| Bohio, *paratype* | 2.58 | .41 | .44 | .82 | .41 |
| ♀ | | | | | |
| Paraiso, *allotype* | 2.92 | .46 | .48 | .94 | .46 |
| Paraiso, *paratypes* (4) | 2.79–3.06 | .42–.48 | .49–.5 | .86–.94 | .44–.48 |
| Bohio, *paratype* | 2.75 | .44 | .47 | .85 | .44 |

*Type:* exposed length of wing, .4; width of tegmen, .52; width of abdomen, .68 mm. *Allotype:* width of abdomen, .95 mm.

To the naked eye, the insects appear ochraceous-buff, suffused with fuscous black on the tegmina and medio-distal portion of the abdomen, before which a brief whitish area is apparent. Under the microscope the coloration is seen to be: (Intensive.) Head russet. Antennae ochraceous-tawny, with the last two or three segments blackish brown. Pronotum ochraceous-tawny, deepening meso-caudad to blackish brown; narrowly margined, except cephalad, with light buff, this broadest meso-caudad. Tegmina mummy brown, shading to ochraceous-tawny cephalad and margined with light buff at the distal curvature of the costal margin. Exposed portion of wings blackish brown. Abdomen with second dorsal segment blackish brown laterad, broadly ochraceous-buff between, with a faint tinge of cinnamon brown mesad; third dorsal segment ochraceous-buff, with latero-dorsal tufts of whitish hairs and a weak suffusion of cinnamon brown mesad; other segments blackish brown. Forceps russet. Cephalic limbs and median and caudal femora and tarsi ochraceous-tawny; median tibiae mummy brown, caudal tibiae blackish brown. (Recessive.) Dark areas less extensive, abdomen alone different: fourth dorsal segment with large lateral areas of blackish brown, elsewhere weak ochraceous-tawny; succeeding segments weak ochraceous-tawny. The recessive condition is indicated, but only weakly, in two males; this condition, however, is shown in all the females before us. The single immature example is very strongly intensive in coloration.

*Specimens Examined:* 14; 6 males, 7 females and 1 immature individual.

Bohio, Canal Zone, Panama, II, 7 and IV, 7, 1911, (Schwarz; Jennings), 1 ♂, 1 ♀, *paratypes*.

Paraiso, C. Z., Pan., I, 1 to IV, 10, 1911, (Schwarz; Busck; Jennings), 4 ♂, 6 ♀, *type*, *allotype*, *paratypes*, 1 juv.

Panama, C. Z., Pan., 1911, (A. H. Jennings), 1 ♂, *paratype*.

SPARATTINAE

**Sparatta pulchra** Borelli

1906. *Sparatta pulchra* Borelli, Boll. Mus. Zool. Anat. comp. Univ. Torino, xxi, no. 531, p. 11. [Escazu, Costa Rica.]

Alhajuelo, Panama, IV, 7, 1911, (A. Busck), 1 ♂, 1 ♀.

## Forficulidae

### FORFICULINAE

**Doru lineare** (Eschscholtz)

1822. *Forficula linearis* Eschscholtz, Entomogr., p. 81. [Santa Catharina, Brazil.]

Tabernilla, Canal Zone, Panama, VI, 14, 1907, (A. Busck), 1 ♀.

Cabima, Pan., V, 28 and 30, 1911, (Busck), 1 ♂, 1 ♀.

Panama, Pan., VI, 1915, (Harrower), 1 ♂, 1 ♀.

These specimens are small for the species, the males with forceps rather slender and with the usual meso-distal tooth very small.

### NEOLOBOPHORINAE

**Neolobophora ruficeps** (Burmeister)

1838. *F[orficula] ruficeps* Burmeister, Handb. Ent., ii, abth., ii, i, p. 755. [Mexico.]

Culebra, Canal Zone, Panama, 1910, (H. H. Rousseau), 1 ♂, [U. S. N. M.].

Panama, Pan., VI, 1915, (Harrower), 1 ♀.

These records extend the known distribution of the species southward from Costa Rica.

### ANCISTROGASTRINAE

**Praos championi** (Bormans)

1893. *Ancistrogaster championi* Bormans, Biol. Cent.-Amer., Orth., i, p. 10, pl. II, fig. 13. [Chiriqui Volcano, Panama, at 2500 to 4000 meters.]

Boquete, Panama, III, 19, 1914, (J. Zetek), 2 ♂.

These specimens agree fully with the type, except in having the exposed portion of the wings immaculate and but a single disto-median internal tooth on each arm of the forceps. These features are attributable entirely to individual variation. Length of body, 9 and 11.6; of forceps 7.1 and 7.3 mm.

After comparison of this species, chosen as genotype of *Vlax* by Burr, with *perditus*, chosen as genotype of *Praos* by the same author, we are astonished to find that his generic description of *Vlax* is evidently drawn from other species there included and that the selected genotypes of these two genera are clearly con-

generic. Hence *Vlax* falls for the older *Praos*. The following comparison of *perditus* and *championi* shows their affinity, and the characters here given may be considered diagnostic for the genus *Praos*.

Tegmina fully developed (*championi*) or abbreviated (*perditus*), with costal margin keeled throughout. Wings fully developed (*championi*) or not showing (*perditus*).[40] Abdomen broadening to just beyond median point, with lateral outline convex and dorsal surface subdeplanate, feebly convex; third to sixth segments with dorso-lateral angles acute-angulate produced, with oblique keels, which ascend caudad, so that the apices of these angles are above the adjacent dorsal abdominal surface, these projections more decided on fourth and fifth segments; stink glands of third segment weak, of fourth segment well developed; seventh and eighth segments feebly produced dorso-laterad; ninth with only brief caudal margin showing. Ultimate dorsal abdominal segment with weak convexities at bases of forceps and brief ridges laterad, which diverge caudad (these stronger in *championi*); latero-ventral margin of this segment terminating in a minute, slender, conical projection at the lateral projection of the penultimate ventral abdominal segment. (Though very similar in general character, the forceps of *perditus* do not have a proximo-internal tooth, such a tooth is strongly developed in *championi*.) Penultimate ventral abdominal segment produced latero-caudad in slightly divergent projections. Caudal metatarsus longer than third tarsal joint.

OPISTHOCOSMIINAE

**Dinex americanus** (Bormans)

1893. *Opisthocosmia americana* Bormans, Biol. Cent.-Amer., Orth., i, p. 8, pl. I, figs. 22 and 23. [Teapa, Tabasco, Mexico; Upper Amazon [South America]. ]

Alhajuelo, Panama, IV, 17, 1911, (Busck), 1 ♀.
Bohio, Canal Zone, Pan., II, 7, 1911, (Schwarz), 1 ♂.
Frijoles, C. Z., Pan., (A. H. Jennings; from flowers of "Lingua de Vaca"), 1 ♂.
Paraiso, C. Z., Pan., I, 26, 1911, (Schwarz), 1 ♀.

This species is discussed under *S. anomalia*. In specimens of recessive coloration, the proximal antennal joints are somewhat darkened. In the male from Bohio, the forceps are not as highly specialized as is normal; the dextral shaft is simple, without the characteristic heavy tooth.

[40] Different degrees of development of the organs of flight are clearly of no generic value in the present subfamily.

**Sarcinatrix anomalia** Rehn

1903. *Opisthocosmia* (*Sarcinatrix*) *anomalia* Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 308. [Turrialba and San Carlos, Costa Rica.]

Trinidad River, Pan., V, 2, 1911, (Busck), 1 ♂.

Alhajuelo, Pan., IV, 19, 1911, (Busck), 1 ♀.

It is hard to understand Burr's removal of the present genus and species to the Ancistrogastrinae. Careful comparison with *americanus*, genotype of *Dinex*, shows without question the close relationship of these genera. That *Dinex* is a characteristic Opisthocosmiine genus is agreed by all. The entire structure of *Sarcinatrix* shows close agreement with *Dinex*, excepting the faintly suggested tegminal keel and the very remarkable character of the male forceps and penultimate ventral abdominal segment. This tegminal condition and the production of the penultimate ventral male abdominal segment are given by Burr as showing Ancistrogastrine affinity. The development of a tegminal keel is found in other genera of the Opisthocosmiinae, so this condition can not be used for assignment to one of the two subfamilies under consideration. The specialization of the penultimate ventral male abdominal segment is anomalous, no approach to such development being found in any known species of the Dermaptera. That it would seem to be a high specialization of the not thickened projections of this segment characteristic of some, not all, of the species of the Ancistrogastrinae, as argued by Burr, would appear to be true for Burr's figure,[41] but this figure is either incorrectly drawn, or is taken from an example of a different species, the projections of the segment in *anomalia* being not large rounded lobes, but large, heavy, recurved, spiniform processes, which curve outward and upward, flanking the bases of the cerci, as described by Rehn.

The Ancistrogastrinae and Opisthocosmiinae, though at present poorly characterized, clearly represent valid divisions.

The head and pronotum in *Dinex americanus* and *Sarcinatrix anomalia* are very similar; the head has the meso-caudal depression, and transverse, arcuate sulcus between the caudal margins of the eyes, more decided in *anomalia*; the strikingly colored and annulate antennae are similar in these species; the pronotum is

[41] Proc. U. S. Nat. Mus., xxxviii, p. 431, fig. 5. (1911).

similar in outline, contour and almost in color, its caudal margin is convexo-truncate. The tegminal and wing coloration is very different. The caudal tarsal joints are slightly shorter in *anomalia*, but in both species of the same proportionate length, the metatarsus about equalling the combined length of the second and third joints.

The specimens here recorded agree fully with the typical series, except that the coloration is more intensive. The limbs and antennae, to tip of fifth joint, are obscure sudan brown; the tip of the sixth and tenth antennal joints and all of the seventh, eighth, eleventh and twelfth are black; the ninth and proximal portion of the tenth joints are white. The head and pronotum are shining blackish brown, the latter margined laterad and caudad with buffy.[42] The tegmina and wings are shining zinc orange, the former margined on all sides with a narrow suffusion of blackish brown.

[42] This buffy marginal marking is only found laterad in *Dinex americanus*.

EXPLANATION OF PLATE

## Plate XXVI

The pygidial and antennal figures are all greatly enlarged.

Fig. 1.—*Prosparatta humilis* new species. Dorsal view of male pygidium. *Type.*

Fig. 2.—*Prosparatta humilis* new species. Dorsal outline of apex of female abdomen and forceps. *Allotype.* (× 7)

Fig. 3.—*Labia micans* new species. Dorsal view of male pygidium. *Type.*

Fig. 4.—*Labia micans* new species. Dorsal view of apex of female abdomen and forceps. *Allotype.* (× 23)

Fig. 5.—*Microvostox bilineatus* (Scudder). Dorsal view of male pygidium. Ancon, Panama.

Fig. 6.—*Geracodes litus* new species. Dorsal outline of female. *Type.* (× 10)

Fig. 7.—*Geracodes litus* new species. Outline of proximal antennal joints. *Type.*

Fig. 8.—*Barygerax esau* new species. Dorsal outline of male. *Type.* (× 11)

Fig. 9.—*Barygerax esau* new species. Outline of proximal antennal joints. *Type.*

Fig. 10.—*Gerax phantasma* new species. Dorsal outline of male. *Type.* (× 11)

Fig. 11.—*Gerax phantasma* new species. Outline of proximal antennal joints. *Type.*

Fig. 12.—*Eugerax poecilum* new species. Dorsal outline of male. *Type.* (× 12)

Fig. 13.—*Eugerax poecilum* new species. Outline of proximal antennal joints. *Type.*

Fig. 14.—*Eugerax poecilum* new species. Ventral outline of distal portion of male abdomen and forceps, showing projecting spines. *Type.* (× 32)

Fig. 15.—*Eugerax poecilum* new species. Dorsal view of female. *Allotype.* (× 12)

# ON ORTHOPTERA FROM THE VICINITY OF RIO DE JANEIRO, BRAZIL

BY JAMES A. G. REHN

The interesting collection here discussed was made in April, 1913, by Dr. Malcolm Burr, the distinguished British Dermapterist and Orthopterist, in the course of a brief stay in the neighborhood of Rio de Janeiro. Dr. Burr very kindly placed the collection in our hands for study, permitting us to retain for the Academy collection the first set, while a second set will be forwarded to the Oxford Museum. The localities represented are: Tijuca, on the southwestern outskirts of the metropolis; Petropolis, immediately over the crest of the neighboring Serra de Estrella to the northward, and the city of Rio itself, a very few specimens being so labelled.

The particular interest which attaches to the collection is that it is from a region, which, although the metropolitan center of Brazil, has been neglected by entomologists in recent years, so much so that certain species described from the locality by the older authors have been generally misidentified by subsequent workers. In proportion to its size, therefore, the present series has been of exceptional interest and great value.

The collection comprises two hundred and eighty-seven specimens, representing forty species belonging to thirty-three genera, of which one genus and three species proved to be new. A key to the species of the genus *Symphyloxiphus*, which was made possible largely by the present material, has been added.

We wish to thank Dr. Burr for his kindness in permitting us to study this most important though limited series.

## BLATTIDAE

### Pseudomopinae

**Ischnoptera parvula** Saussure

1868. *I[schnoptera] parvula* Saussure, Revue et Magasin de Zoologie, 2e ser., xxi, p. 112. [Brazil.]

Petropolis. April 12 to 14, 1913. Two females.

This strikingly distinct species is here first recorded from South America with exact locality.

### Epilamprinae

**Epilampra agathina** Saussure

1864. *Epilampra agathina* Saussure, Revue et Magasin de Zoologie, 2e ser., xvi, p. 322. [Brazil.]

Petropolis. April 12 to 14, 1913. One female.

Walker has recorded this species from Tijuca and Constancia, Brazil.

**Epilampra verticalis** Burmeister

1838. *E[pilampra] verticalis* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 505. [Brazil.]

Tijuca. April 9 to 11, 1913. One female.

This specimen is inseparable from material from the Misiones, Argentina.

### Panchlorinae

**Pycnoscelus surinamensis** (Linnaeus)

1758. [*Blatta*] *surinamensis* Linnaeus, Syst. Nat., X ed., p. 424. [Surinam.]

Petropolis. April 12 to 14, 1913. One female.

### Oxyhaloinae

**HYPNORNOIDES** new genus

Allied to *Hypnorna* Stål, from which it differs in the shorter, more ovate instead of elongate form, in the head being without a distinct transverse sulcus and carina between the face and vertex, in the tegmina being relatively broad, not acuminate, and with a distinct anal impression on the same. It is not close to the related *Calhypnorna*.

*Generic Description.*—Depressed, ovate in form. Face and vertex passing regularly one into the other, non-carinate or sulcate: antennae short, moniliform, hirsute. Pronotum roughly quadrate: lateral portions defined, translucent. Tegmina coriaceous, short lanceolate: venation distinct but not elevated; anal sulcus distinct: marginal field sharply defined, narrow. Wings with small reflexed intercalated area. Ante-penultimate dorsal abdominal segment produced latero-caudad into a distinct projection: subgenital plate of female deeply fissate and semi-valvate. Femoral margins without true spines: dorsal genicular spine

present on median and caudal femora: ventral margins of median and caudal femora, and ventro-cephalic margin of cephalic femora each with a single distal spine. Arolia large.

Type.—*Hypnornoides burri* new species.

**Hypnornoides burri** new species (Pl. XXVII, figs. 1 and 2.)

Type.— ♀ ; Petropolis, State of Rio de Janeiro, Brazil. April 12 to 14, 1914. (M. Burr.) [Acad. Nat. Sci. Phila., Type no. 5249.]

Size small: form markedly depressed: surface of pronotum and tegmina dull and minutely shagreenous, of remainder of body moderately polished but frequently with a very weak shagreen. Head with its width visible cephalad of the pronotum, the occiput greatly flattened, the general outline of the head trigonal when seen in cephalic aspect: occiput rounding regularly over the vertex into the face: interspace between the eyes very broad, slightly greater than that between the inner margins of the antennal scrobes, the interocular region ventrad to the interantennal region with spaced, distinct, stellate impressions, from which spring single chaetiform hairs; region of the antennal scrobes marked off from the vertex by arcuate, converging and ventrad vanishing angles: clypeus and labrum strongly transverse: palpi with third joint rather slender, straight; fourth joint distinctly shorter than the third, funnel-shaped; fifth joint subequal to the third, of the typical Blattid form, the greatest width at the proximal third: eyes strongly depressed, elongate reniform in outline: antennae very slightly longer than the body, multiarticulate, the articles moniliform, very short proximad, increasing in length distad, the distal joints very slightly longer than broad; proximal joint thickened, second and third joints larger than fourth and succeeding; from fourth joint distad the antennae are adpressed hirsute. Pronotum faintly transverse, roughly quadrate in form, greatest width at caudal fourth: cephalic margin regularly arcuate, rounding into the weakly oblique, gently diverging and slightly arcuate lateral margins; caudo-lateral angles rounded obtuse; caudal margin very slightly arcuate: surface of disk with complicated less shagreenous pattern: lateral portions of pronotum narrow, flattened, translucent, the disk sharply and narrowly rounding ventrad to the level of the lateral portions. Tegmina lanceolate, the greatest width contained nearly two and one-half times in the greatest length of the same, and situated at three-fifths of the length from the base; coriaceous, the marginal field mottled translucent, the portion of the dextral tegmen normally covered when the tegmina are closed, shining, but with a distinct and rather modified venation: costal margin faintly arcuate proximad, thence obliquely straight to the point of greatest width, which is broadly rounded and from where the margin is obliquely arcuato-truncate to the rounded rectangulate apex, which is faintly sutural in position; sutural margin very faintly arcuate, strongly rounded proximad to the base, rounding in similar fashion distad to the apex: marginal field relatively narrow, attenuate, reaching to the point of greatest width of the tegmen, flattened and

sharply delimited by contour, as well as texture and color, from the remainder of the tegmen; anal field elongate pyriform, its apex nearly at the middle of the sutural margin: venation partly obscured by the coriaceous character of the tegmina and at the same time lacking sharp definition in its own structure (except in the shining, normally covered portion of dextral tegmen); eight to nine costal veins distinguishable; discoidal and median veins parallel for a considerable distance, three apparent discoidal rami, which are obliquely directed toward the sutural margin, are present; anal sulcus impressed, delicate, continuous, gently arcuate; axillary veins four in number, relatively faint. Wings subequal to the tegmina in length: costal margin slightly oblique and straight in proximal three-fifths, thence truncate and distad sharply arcuate to the base of the intercalated field: intercalated field of medium size, folded and reflexed, the base obtuse-angulate, the greatest length of the field equal to about one-sixth that of the remainder of the wing: mediastine vein continued to the apex of the field, following the trend of the costal margin in the proximal half, there bent and continuing distad at a very broad obtuse angle; costal veins irregular, nine in number, hardly clavate; area between the mediastine and discoidal veins very broad, at greatest width almost equal to the distance from the discoidal to the anal vein, the latter following much the same direction as the mediastine vein, area with seven transverse nervures, which are not parallel in direction, the areolets distad, however, being subquadrate; medio-discoidal area narrow, hardly half as wide as the medio-ulnar area; median vein following the same general trend of the above described veins, the medio-ulnar area with four nervures distad. Abdomen with the ante-penultimate dorsal segment well produced into rectangulate projections latero-caudad: supra-anal plate transverse, trigonal, compressed and subrostrate mesad, the free margin broadly arcuato-emarginate laterad, the median compressed section with a very shallow obtuse-angulate emargination, each side of which emargination on the compressed section is placed a group of chaetiform hairs: cerci twice as long as the supra-anal plate, tapering, acuminate, dorsal surface depressed, ventral surface with numerous chaetiform hairs: subgenital plate large, weakly compressed proximo-laterad, distad with a considerable median fissation, the free margin in general form sub-rectangulate. Caudal tarsi with the metatarsus subequal in length to the remaining tarsal joints.

General color of the dorsal surface burnt sienna, of the ventral surface blackish brown. Head with the occiput, interocular region and face to the level of the ventral portion of the antennal scrobes orange rufous; ventral portion of the face and mouth parts of the color of the ventral surface, with weak points of orange rufous on the face, the palpi in part, and the labrum edged with dull ochraceous-orange; eyes blackish brown; antennae black, the first and third joints to a variable degree orange rufous, mesad with a broad cream white annulus involving eight joints, distad the black passes into ochraceous-tawny.[1] Pronotum with the disk approaching chestnut, weakly mottled with darker (dull fuscous), particularly caudad and laterad, lateral portions of the pronotum ochraceous-buff. Tegmina with the marginal field whitish. Dorsum of the

[1] As the antennae are incomplete in the type, certain of these characters have been drawn from the paratype.

abdomen with a broad, proximal, transverse bar of shining blackish brown, this breaking up before reaching the lateral abdominal margins. Venter of the abdomen with the segments narrowly edged laterad and distad with the dorsal color, the edging irregular in strength and continuity; subgenital plate with ill-defined blotches of the same; cerci of the dorsal color, darkening distad. Coxae of the ventral color proximad, naples yellow distad; femora naples yellow, this passing distad into ochraceous-orange; tibiae similar to the distal portion of the femora, excepting the caudal pair, which are hazel; tarsi naples yellow, excepting the ultimate and penultimate articles which are dresden brown.

*Measurements (in millimeters)*

| ♀ | Length of body | Length of pronotum | Greatest (caudal) width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| Petropolis, Brazil | | | | | |
| *Type* | 7.5 | 1.9 | 2.2 | 4.6 | 1.9 |
| *Paratype* | 7.3 | 2 | 2.3 | 4.8 | 1.9 |

In addition to the type we have before us a paratypic female bearing the same data as the type. It shows no noteworthy differences excepting some minor color differences. These are the presence of fuscous disto-mesad on the cephalic femora and to a lesser degree proximad on the cephalic tibiae, the obsolete character of the paler palpal markings and the reduction of the paler ventral abdominal marginings. These show that the specimen is in a slightly more intensive condition of coloration than the type.

**Chorisoneura bisignata** new species (Pl. XXVII, figs. 3, 4, 5 and 6.)

Apparently allied to *C. discoidalis* Burmeister, but differing in the entirely black front and vertex of head, in the pale humeral line on the tegmina and in the smaller size.

Type.—♂; Petropolis, State of Rio de Janeiro, Brazil. April 12 to 14, 1913. (Malcolm Burr.) [Acad. Nat. Sci. Phila., Type no. 5261.]

Size medium (for the genus): form depressed, elliptical: surface shining. Head distinctly projecting cephalad of the pronotum, visible for almost its entire width: occipital outline with the eyes, when seen from the dorsum, moderately arcuate; interspace between the eyes very broad, subequal to that between the antennal scrobes: eyes narrow, strongly elongate and reniform in basal outline: ocelli minute, elongate elliptical; face with the antennal depressions strongly defined mesad by strongly arcuate rims: palpi with the third joint moderately slender, slightly longer than the fourth joint; fourth joint nearly subequal to the fifth joint, faintly and regularly enlarging distad; fifth joint of the usual type, tapering in the distal three-fifths: antennae at least as

long as the body (their condition incomplete). Pronotum transverse, flattened elliptical, the greatest length contained about one and two-fifths times in the greatest width: cephalic margin very broadly and shallowly obtuse-angulate, the immediate angle broadly rounded; caudal margin similar but more arcuate and with a faint median flattening; latero-cephalic angles rounded, latero-caudal angles rounded obtuse; lateral margins strongly and regularly arcuate: disk with a weakly impressed pattern; broad lateral and narrow caudal sections semi-transparent, the former well separated from the disk by distinct breaks in the contour of the pronotum: entire margin finely cingulate. Tegmina elongate, very narrowly lanceolate, nearly four times as long as the greatest width: costal margin strongly arcuate proximad, thence very faintly and quite regularly truncato-arcuate to the acute apex; sutural margin straight, becoming arcuate in distal third: marginal field of medium width, well-defined, reaching to the proximal two-fifths; scapular field broad, at its widest point hardly inferior to the width of the discoidal field; anal field pyriform, reaching to the proximal third of the tegmen: venation distinct, coarse, well etched into relief; costal veins eighteen in number, oblique, irregular distad, the intercalated veins of scapular field decided and regularly placed; median vein in greater part subparallel to the discoidal vein, sinuate in form, with six oblique rami toward the sutural margin; ulnar vein bifurcate distad; whole of the discoidal field with numerous, closely placed and strongly marked cross-veins, which give a rectangulate or rarely quadrate form to the cells; anal sulcus well indicated, distinctly arcuate proximad, thence straight oblique, faintly arcuate at its junction with the sutural margin; axillary veins five in number, well-defined, with but indistinct cross-veins. Wings falling but slightly short of the tegminal apices; costal margin in greater part gently arcuate: intercalated triangle relatively large, its greatest length equal to about one-third that of the remainder of the wing: costal veins sixteen in number, the proximal eleven thickened distad and weakly elongate clavate; discoidal vein in general straight; medio-discoidal area rather broad, appreciably wider than the medio-ulnar area, cross-veins fifteen in number, the cells varying from very narrow spaces to elongate rectangles; median vein very faintly arcuate, simple, medio-ulnar area with about six faint cross-veins, irregularly placed distad; ulnar vein heavy and straight, furcate distad, the main trunk there sending three weak cross-veins toward the anal vein. Abdomen narrowed distad: disto-dorsal abdominal segment transverse, the free margin moderately arcuate: cerci large, coarsely jointed, tapering, strongly depressed, sparsely hirsute: subgenital plate of the usual *Chorisoneura* type, the free margin unsymmetrical, from the sinistral side showing the following: a strong proximal rotundate acute-angulate shoulder, a rounded but not deep emargination, a median sinuate and slightly oblique truncation, a more pronounced, though narrow, arcuate emargination and lastly a short bisinuate section; styles of the usual large, acuminate, sublammellate type found in this genus, ventral surface of same deeply channelled. Cephalic femora with the ventro-cephalic margin bearing a closely set series of setiform spinules distad; median and caudal femora with the ventral margin having few scattered spinules; ventro-cephalic margin of cephalic femora with a large distal spine, both ventral margins of median and caudal femora with similar, but smaller, single distal spines: arolia large.

General color fuscous-black, the pale pattern pale ochraceous-buff to naples and mustard yellow. Head fuscous-black excepting the mouth-parts, which are buff, the palpi naples yellow, the distal joint tipped with fuscous. Pronotum with the disk of the general color, the broad lateral borders, the narrower caudal margin and a fine thread along the cephalic margin, pale ochraceous-buff, the caudal outline of the dark disk sharply contrasted, the others faintly blending. Tegmina of the general color, with the marginal field and a broad marginal edging to nearly the whole of the scapular field, dull naples yellow, and a strongly contrasted, but relatively narrow, dash along the greater part of the discoidal vein mustard yellow. Wings strongly washed with fuscous. Abdomen with the dorsal surface buckthorn brown, broadly but indefinitely edged laterad and distad with weak fuscous; cerci mustard yellow: ventral surface of thorax and coxae, excepting an isabelline wash to the cephalic coxae, of the general color of the abdomen, colored similarly to the dorsum of the same section, but with the fuscous lateral marginal areas deeper in tone and more sharply defined, while distad the subgenital plate is of the paler color. Limbs naples yellow; tarsi with a distal spot of fuscous and small ones of the same color at the base of the second and fourth joints.

Length of body, 6.9 mm.; length of pronotum, 1.8; greatest width of pronotum, 2.5; length of tegmen, 8.8; greatest width of tegmen, 2.5.

The type of this striking species is unique.

**Chorisoneura perlucida** (Walker)

1868. *Blatta perlucida* Walker, Catal. Blatt. Brit. Mus., p. 99. [Tijuca, Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One male.

This topotypic specimen fully answers the poor description of Walker as far as the latter goes except that the eyes are hardly "wide apart." However, as the type was a female, and the present individual is of the opposite sex, this is easily explained, as the difference in this respect is always more marked in the females of the Blattidae.

The only locality from which the species has been recorded is Tijuca.

PERISPHAERINAE

**Hormetica laevigata** Burmeister

1848. *H[ormetica] laevigata* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 512. [No locality.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One male, one female.

A study of the characters given by Burmeister for this species and his supposed synonymous *scrobiculata* shows conclusively

that Brunner erred in uniting them. That this was done is, however, not at all strange, Brunner's measurements showing that he had but the present species before him, although he should have given more attention to the features given by Burmeister in the key section of the page on which both forms were described. Burmeister says of *laevigata*, "Flügeldecken reichen bis fast ans Ende des Hinterleibes und griefen über einander"; while of *scrobiculata* he writes, "Flügeldecken merklich kürzer als der Hinterleib." The present species has, in both sexes, the tegmina longer than in any other form of the genus known to us. Serville's name *robusta* and *laevicollis* are clearly based on the sexes of the same species which Burmeister called *scrobiculata*.

The three closely allied species of this section of the genus, specimens of each of which are now before us, may be recognized by the following key.

A. Tegmina not as long as or but slightly longer than the greatest width of pronotum, exposing four to five abdominal segments; apex relatively broad. Wings shorter than tegmina. Lateral margins of pronotum of male but moderately arcuate.

B. Tegmina with length little greater than their individual width; distal extremity subtruncate; distal portion of costal margin strongly arcuate. **scrobiculata** Burmeister

BB. Tegmina with length appreciably greater than their individual width; distal extremity well rounded; distal portion of costal margin obliquely subarcuate. **atlas** Rehn

AA. Tegmina about a third longer than the greatest width of the pronotum, exposing about three abdominal segments; apex relatively narrow, rounded. Wings as long as tegmina. Lateral margin of pronotum of males considerably arcuate. **laevigata** Burmeister

Measurements (in millimeters) of the three forms are as follows:

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| *Hormetica laevigata* ♂ (ex Burmeister) | circa 30 | .... | .... | .... | .... |
| *Hormetica laevigata* ♂ (Amazons) | 34 | 13.5 | 17 | 14.7 | 12.5 |
| *Hormetica atlas* ♂ (Type) | 45.5 | 15.5 | 19.5 | 18.5 | 14.2 |
| *Hormetica atlas* ♀ (Allotype) | 35.5 | 11 | 14.5 | 12.8 | 10 |

| | Length of body | Length of pronotum | Greatest width of pronotum | Length of tegmen | Greatest width of tegmen |
|---|---|---|---|---|---|
| *Hormetica scrobiculata* ♂ (ex Brunner) | 40 | 13 | 18 | 22 | .... |
| *Hormetica scrobiculata* ♀ (ex Brunner) | 31 | 11 | 15 | 18 | .... |
| *Hormetica scrobiculata* ♂ (Petropolis) | 36 | 12.9 | 16.2 | 20.8 | 11.9 |
| *Hormetica scrobiculata* ♀ (Petropolis) | 36.5 | 11.5 | 15 | 19.4 | 11.1 |

## MANTIDAE

### Vatinae

**Cardioptera brachyptera** Burmeister

1838. *M[antis (Cardioptera)] brachyptera* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 541. [Brazil.]

Tijuca. IV, 9 to 11, 1913. (M. Burr.) One juv. female.

## ACRIDIDAE

### Acrydiinae

**Rytinatettix**[2] **lobulatus** (Stål)

1860. *Tetrix lobulata* Stål, Kongl. Svenska Fregatt. Eugenies Resa, Zool., i, p. 347. [Rio de Janeiro, Brazil.]

Petropolis. April 12 to 14, 1913. (Burr.) One female.

This species has also been recorded from Nova Friburgo, Brazil and Argentina, as well as from the Amazon region,[3] but we feel misgivings as to the latter identification.[4]

[2] Vide Hancock, Trans. Entom. Soc. London, 1908, p. 418, (1908).

[3] Hancock, Ibid., p. 419.

[4] Hancock (Ibid., p. 418) has suggested the probability of Giglio-Tos' *Paratettix borelli* (Bull. Mus. Zool. Anat. Comp. Torino, xii, no. 302, p. 28, (1897)) being the same as Stål's *lobulata*. This does not appear to us to be the case, as in our opinion it equals the allied *Rytinatettix fossulatus* (Bolivar) (Ann. Soc. Entom. Belg. xxxi, p. 256, (1887)). We have specimens from Argentina before us which fully agree with *borelli*, and were so determined by Bruner, and these are clearly *fossulatus*. Our previous references of material to *lobulatus* (Proc. Acad. Nat. Sci. Phila., 1913, p. 304) should instead relate to *fossulatus*, true *lobulatus* previous to this writing having been unknown to us. The localities from which *fossulatus* is now known are: Rio de Janeiro, State of Apiahy, Rio Grande do Sul, Corumbá and Chapada, Brazil; Caiza and Puerto Suarez, Bolivia; Paraguay; San Lorenzo, Misiones, Embarcacion, Jujuy, Tucuman, Cruz del Eje, Cordoba, Carcaraña, Rosario and Buenos Aires, Argentina; Lota, Chile.

### Proscopinae

**Corynorhynchus radula** (Klug)

1820. *Proscopia radula* Klug, in Nees ab Esenbeck, Horae Physicae Berolin, p. 20, pl. iii, fig. 4. [Rio de Janeiro, Brazil.]

Tijuca. April 9 to 11, 1913. (M. Burr.) One male.

This species has been recorded from as far north as Surinam.

### Acridinae (*Truxalinae* of authors)

**Truxalis brevicornis** (Johannson)

1764. *Gryllus brevicornis* Johannson, Amoen. Acad., vi, p. 398. [Pennsylvania.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One male.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Four males, four females.

All of the above specimens are in the green color phase. The four Petropolis females vary in tegminal coloration from immaculate to rather thickly punctate with circular spots in the discoidal area.

**Orphula pagana** (Stål)

1860. *Gomphocerus* (*Hyalopteryx*) *paganus* Stål, Kongl. Svenska Freg. Eugenies Resa, Zool., i, Ins., p. 339. [Rio de Janeiro, Brazil.]

1906. *Orphulina veteratoria* Rehn, Proc., Acad. Nat. Sci. Phila., 1906, p. 21. (In part, male only.) [São Paulo, Brazil.]

1911. *Orphulella crassa* Bruner, Ann. Carneg. Mus., viii, pp. 12, 17. [Rio de Janeiro, Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Fifteen males, four females.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Ten males, fifty-three females.

The author has already pointed out the unfortunate, but universal, misidentification of this species by authors,[5] and the student is referred to the earlier paper for discussion of this matter.

The genus and species is a member of the Orphulellae, being near *Sisantum* and *Orphulina*, with a more distant relationship to *Parorphula* and *Orphulella*. In addition to *pagana* the genus contains certain other forms, i. e. *Orphulina veteratoria* Rehn (♂ not ♀), *Orphula gracilicornis* Bruner, *Orphula azteca* (Saussure) and *meridionalis* and *guatemalae* Bruner. We now have

[5] Trans. Amer. Entom. Soc., xlii, p. 275, (1916).

before us the types of *veteratoria*, *meridionalis* and *guatemalae*, topotypes of *gracilicornis* and two males of *azteca* determined by Bruner after comparison with Saussure's type. It is evident that the male of *veteratoria* equals true *pagana*, which at the time of the description of *veteratoria* was interpreted in the sense used by Giglio-Tos and Bruner, determined Asuncion material from the latter author being at that time in our hands; the female of *veteratoria*, which is the type, stated when described as probably different from the male, is the same as *O. acuta*, described by us several pages later in the same paper. Bruner's *gracilicornis*, which was considered a *Sisantum* by us,[6] is a quite different member of this group, while *meridionalis*, *azteca* and *guatemalae* are closely related, so much so that we prefer not to comment further on them until series are available. Bruner's *Orphulella crassa*, described from Rio de Janeiro, agrees completely with the material now before us, and is clearly a synonym of *Orphula pagana*.

The rather extensive series of this species now before us shows there is some size variation and also some slight fluctuation in the degree of angulation of the fastigium, but in no case is this sufficiently marked to prevent the ready recognition of the species. The tegmina and wings surpass the apices of the caudal femora in but a single specimen, a male, in which the difference is slight. All the males seen are in the brown phase and in the female sex the green phase is scarcer than the brown one, but fifteen being in the completely colored green phase and four with the dorsum green.

The species is known from the vicinity of Rio de Janeiro, several localities in the state of São Paulo, from the state of Espirito Santo (recorded by us as *Orphulina veteratoria*) and Sete Lagoas, Minas Geraes (recorded by Bruner as *Orphulella crassa?*).

**Orphulella punctata** (DeGeer)

1773. *Acrydium punctatum* DeGeer, Mém. Hist. Ins., iii, p. 503, pl. 42, fig. 12. [Surinam.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Three females.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Two females.

[6] Entom. News, xxii, p. 250, (1911).

**Amblytropidia robusta** Bruner

1906. *Amblytropidia robusta* Bruner, Proc. U. S. Nat. Mus., xxx, p. 631. [Sapucay, Paraguay.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Seven males, two females.

These specimens are slightly different from a topotypic series of this species, the caudal femora of the females averaging slightly more slender. This feature, however, shows relatively considerable variation in the Sapucay material, and the difference between the Tijuca females and the average of the topotypes of that sex (seven in number) is no greater than the individual variations in this feature among the latter series. One of the females has a pale subcostal tegminal line, which is lacking in all the other individuals of *robusta* seen by us. As we know this variation occurs in *A. vittata* the feature is only individual.

The range of the species is considerably extended to the eastward by the present record, the previously known localities for the species being Sapucay and Puerto Bertoni, Paraguay and the Misiones, Argentina.

**Peruvia ensicornis** (Rehn)

1913. *Fenestra ensicorne* Rehn, Proc. Acad. Nat. Sci. Phila., 1913, p. 83, figs. 1 and 2. April 30, 1913. [Espirito Santo, Brazil.]

1913. *Toxopterus orientalis* Bruner, Ann. Carneg. Mus., viii, p. 449. May 5, 1913. [Rio de Janeiro, Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One male, one female.

For the use of *Peruvia* Scudder in place of *Toxopterus* Bolivar, see the recent discussion of the problem by the author.[7] The above synonymy is evident after a careful study of the type of *ensicorne* and the description of *orientalis*. The type of *ensicorne* has now lost its antennae, and these were evidently incomplete when the species was described and figured, thus the clavate apex was not described.

It is evident from an examination of this species and comparison with the genotypes of *Peruvia* (*P. nigromarginata*) and *Fenestra* (*F. bohlsii*), that the two genera are quite close to one another, the present form constituting, in fact, a connecting link, although

[7] Trans. Amer. Entom. Soc., xlii, pp. 280 and 281, (1916).

nearer *nigromarginata* in the sum total of characters. The wing of the male has the anterior field hyaline as in *Fenestra*, instead of semi-opaque as in *Peruvia*, the posterior field similar in opacity to the radiate field, as in *Peruvia*, instead of hyaline like the anterior field as in *Fenestra*, while the black margin of the radiate field, the opaqueness of the same and the general venation are of the *Peruvia* type. The head is nearer *nigromarginata* in form, but the antennae are nearer *Fenestra* in type except for the clavate extremity. The pronotum is *Peruvia*-like in general form but shortened, with the lateral carinae more irregular and the surface texture very rough. The tegmina are nearer *nigromarginata* in form and vein disposition. The caudal limbs are more like those of *Peruvia*.

The female is quite different from the male, being heavily built with abbreviate tegmina and wings, the former not exceeding the base of the supra-anal plate and the wings being slightly shorter than the tegmina. The venation of the female is reduced, but the general plan is that of the male tegmina and wings, the anterior field of the wings, however, being blackish and subopaque. The antennae are strongly depressed, sub-ensiform, with no distal clavation. The measurements of the female are: length of body, 29 mm.; length of pronotum, 6.7; greatest width of pronotal disk (caudad), 3.9; length of tegmen, 14.2; greatest width of tegmen, 4.5; length of caudal femur, 17.7.

The species is apparently restricted to the southeastern coast region of Brazil, where it replaces the interior and Amazonian *P. nigromarginata*. Bruner's record of the latter species (as *Toxopterus miniatus*) from Rio de Janeiro, was in all probability based on the single male which he later described as *T. orientalis*.

## Locustinae

**Diedronotus discoideus** (Serville)

1831. *Tropinotus discoideus* Serville, Ann. Sci. Nat., xxii, p. 273. [Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Three females, two immature females.

This is the most easterly definite record of the species, aside from one of Bahia material given by Pictet and Saussure. We feel rather dubious about this latter record really referring to

*discoideus*, as all the material of the genus we have seen from that portion of Brazil represents the allied *D. angulatus*.

**Elaeochlora trilineata** (Serville)

1831. *Xiphicera trilineata* Serville, Ann. Sci. Nat., xii, p. 272. [Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Three males.

This beautiful species has been recorded from Rio de Janeiro by several authors. It probably replaces, in that general region, *E. viridicata* (Serville), which is rather widely distributed to the southward and southwestward.

**Chromacris miles** (Drury)

1773. *Grylll[us] Loc[usta] miles* Drury, Illustr. Nat. Hist. Exot. Ins., ii, pp. 79 and Index, pl. xlii, fig. 2. [Bay of Honduras.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Three males.

These specimens belong to the color form having the pale, normally exposed, markings decidedly yellow and the wing disk of the same color, while the tegmina are greenish. This phase superficially resembles the Central American *C. colorata*, but the antennae are always entirely black. We have the same phase from Jundiahy, state of São Paulo, and Rio Capivary, state of Santa Catharina, Brazil.

**Leptysma filiformis** (Serville)

1839. *Opsomala filiformis* Serville, Hist. Nat. Ins., Orth., p. 593. [The North of the State of São Paulo, Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Three males, two females, one immature male, one immature female.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One male.

**Vilerna rugulosa** Stål

1878. *V[ilerna] rugulosa* Stål, Bihang K. Svenska Vet. Akad. Handl., v, no. 4, p. 61. [Peru; Rio de Janeiro, Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One male, one female.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One male, one female.

These specimens are specifically identical with previously reported material from several localities in Paraguay, but in

common with other material from the eastern coastal region of Brazil (Espirito Santo and Rio de Janeiro) they have the fastigium narrower in both sexes than in the Paraguayan individuals. The species is known to range northward as far as Pará, Brazil, southward to Santa Catharina, Brazil and westward to northern Argentina.

**Abracris caeruleipennis** (Bruner)

1900. *Jodacris (?) caeruleipennis* Bruner, Second Rep. Merchants Loc. Invest. Comm. Buenes Aires, p. 68. [Asuncion, Paraguay; Territory of Formosa, Argentina.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One male, one female.

These specimens are quite pale in general coloration, in this respect resembling a pair from Chapada, Matta Grosso, Brazil, now before us, but in the case of the Tijuca pair this may be due to specimens having been immersed in alcohol, which, however, was not the case with the Chapada pair. This species is the most variable and perplexing member of the genus, having caused some confusion in our studies of the material of this genus in the past.[8]

The species is known from as far north as the state of Pará, Brazil, and south to the Misiones and province of Formosa, Argentina, west to southern Bolivia.

**Sitalces volxemi** Stål

1878. *S[italces] volxemi* Stål, Bihang K. Svenska Vet. Akad. Handl., v, no. 9, p. 16. [Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One female.

[8] As we have shown elsewhere (Trans. Amer. Entom. Soc., xlii, p. 294, (1916) the following records of *signatipes* made by us refer to *caeruleipennis:* Proc. Acad. Nat. Sci. Phila., 1907, p. 185 (Sapucay, Paraguay) [part]; Ibid., 1908, p. 17 (São Paulo, Brazil); Proc. U. S. Nat. Mus., xxxvi, p. 149 (part: Chapada, Brazil material); Proc. Acad. Nat. Sci. Phila., 1913, p. 339 (Misiones, Argentina); Ibid., 1915, p. 285 (Misiones, Argentina). The closely related *A. conspersipennis* Bruner (Biol. Cent.-Amer., Orth., ii, p. 281, (1908)), from Chapada, Brazil, we have not recognized in the collections in hand. It is described as having the interocular space about as wide as the frontal costa in both sexes (Ann. Carneg. Mus., viii, p. 110, (1911)), a condition we have never seen.

This specimen fully agrees with Stål's description of this apparently little known species. While the median carina of the pronotum is somewhat more evident than Stål's term "obsoleta" would indicate, it is not as solid or sharp as in the allied *S. robustus* Bruner, which is a larger species with a broader interocular space, a sulcate frontal costa and shorter tegmina. This appears to be the first exact record of the species.

**Schistocerca fimbriata** (Thunberg)

1824. [*Gryllus*] *fimbriatus* Thunberg, Mém. Acad. Imp. Sci. St. Pétérsb., ix, p. 428. [Brazil.]

*Schistocerca flavo-fasciata* Stål, Scudder, etc., (not *Acrydium flavo-fasciatum*] DeGeer).

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Two females.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Four males, one female.

As we have already shown[9] DeGeer's *flavo-fasciatum* is distinct from this species, being a form of northern South America. Stål, who examined the type of Thunberg's *Gryllus nitens*, *fimbriatus* and *nitidus*, considered these species to be the same as DeGeer's form, the type of which was missing. Of these names *nitens*, the oldest, seems from the description more likely to be true *flavo-fasciata*. Stål was, of course, unaware of the differences separating the true *flavo-fasciata* (*aequalis* Scudder) and the species called *flavo-fasciata* by Scudder. Thunberg's *fimbriatus* stands next in availability and may be used, at least provisionally, for the present species, as it shows no features of disagreement from the original description.

This species can be readily distinguished in both sexes from *flavo-fasciata* by the narrower marginal field of the tegmina, which as far as available material goes is always rather narrowly striped with pale, while the male cerci are more tapering and never broadly truncate distad as in the other species.

Scudder's *infumata* is quite close to *fimbriata*, as type material of the former now before us shows, and it is very probable that *infumata* will eventually prove to be but a geographic race or an extreme refinement of the characters of *fimbriata*.

The species is known to range from Asuncion and Luque, Paraguay, north to Chapada and Pará, Brazil, east to the vicinity

[9] Trans. Amer. Entom. Soc., xlii, pp. 304 and 305, (1916).

of Rio de Janeiro. We feel there may be some confusion with *flavo-fasciata* in the Pará record.

**Dichroplus punctulatus** (Thunberg)

1824. *Gryllus punctulatus* Thunberg, Mém. Acad. Imp. Sci. St. Pétérsb., ix, p. 408. [Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One male, one female.

This species is widely distributed over South America.

**Dichroplus brasiliensis** Bruner

1906. *Dichroplus brasiliensis* Bruner, Proc. U. S. Nat. Mus., xxx, pp. 678, 682. [Victoria, Brazil.]

Rio de Janeiro. April 9 to 14, 1913. (Malcolm Burr.) Two males, two females.

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Two males, one female.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Three males, thirteen females, two immature females.

These specimens are inseparable from single females from Espirito Santo and São Paulo, Brazil, previously recorded by us. The pale lateral lines on the dorsum are indicated in all the adults in the present series, but subobsolete in the immature individuals. In the males these bars are especially marked. The enclosed dark area varies appreciably in width in both sexes. The species is known only from the coastal section of southeastern Brazil. The record of *brasiliensis* from the territory of Misiones, Argentina, recently made by the author is incorrect, as the single male there reported belongs to an allied new species, which will shortly be described by us. The male genitalia of *brasiliensis* were not described by Bruner, whose only description of the species consists of several features in a key and a few comments on another page, and aside from the features of the genitalia *brasiliensis* and the new form are extremely close. The chief features of the male genitalia of *brasiliensis* are as follows: Furcula distinct but minute, longer than broad, rounded, depressed, closely placed; supra-anal plate acute trigonal, the immediate apex narrowly rounded, median line distad of this subcarinate, elevated, surface subtectate in transverse section, the lateral margins distinctly reflexed proximad, thus forming a

v-shaped trough on each side; cerci slender, subcompressed, when seen from the lateral aspect the proximal half is regularly tapering, the distal half bears a slight widening along the dorsal margin which tapers to the acute apex, when seen from the dorsum the cerci are parallel proximad, faintly incurved from the middle to the distal fourth, thence to the apex straight parallel; subgenital plate moderately produced, subcompressed, apex rounded subrostrate, dorsal margin elongate and narrowly V-shaped, the same gently arcuate when seen from the lateral aspect.

**Dichroplus amoenus** (Stål)

1878. *P[ezotettix]* (*Dichroplus*) *amoenus* Stål, Bihang K. Svenska Vet.-Akad. Handl., v, no. 9, p. 8. [Peru.]

Rio de Janeiro. April 9 to 11, 1913. (Malcolm Burr.) One female.

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Two males, three females, one immature male.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Three males, eleven females.

While a portion of this interesting series has been immersed in a liquid preservative for a short time, and its coloration is in consequence somewhat altered, we find positive evidence in the present material of the occurrence of two distinct color phases in the species. This condition occurs in a few other members of the Melanopli, such as *Melanoplus herbaceus*, but it is relatively uncommon in the Locustinae. The green phase is that described by Stål, with the base color of the caudal femora and cephalic and median limbs and abdomen clear oil green to oil yellow, the femora without transverse bars and the black of the distal extremity strongly contrasted. The brown phase has the green replaced by rufous to ferruginous, the caudal femora with three distinct, transverse, greenish black bars on the dorsal surface, which fuse and color the greater portion of the lateral surface, while the distal extremity of the femora loses its contrasting coloration. The color of the caudal tibiae is changed but little, being but faintly darker in the brown individuals, which have the pale bars on the head and pronotum less strongly contrasted. All the decided brown specimens (two females) are from Petropolis, but another female from the same locality and one of the same sex from Tijuca are nearly intermediate between the two phases, having the dorsal bars on the femora weakly but dis-

tinctly marked, and the lateral face nearly uniform greenish or with faint darker markings. The tegmina vary much in the contrast of their colors, one extreme having their base color with a narrow humeral line of pale ochraceous, the other extreme being pale with a few scattered circular spots of dark color. The solid color of the dorsal field of the tegmina breaks up before the black of the lateral field weakens. The dark extreme of tegminal coloration is more pronounced in the specimens in the green phase, but some of the individuals in the same phase have the contrasts of the tegmina no stronger than in the brown phase specimens.

The only other Brazilian record is of a specimen from Minas Geraës, which is in the green phase.

**Pycnosarcus atavus** (Saussure)

1859. *P[olysarcus] atavus* Saussure, Revue et Magasin de Zoologie, 2é ser., xi, p. 393. [Bahia, Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One male.

This genus and species is known only from eastern Brazil, the localities being Bahia, Minas Geraës and the Rio de Janeiro region.

## TETTIGONIIDAE

### Phaneropterinae

**Phaneroptera nana** Fieber

1853. *Phaneroptera nana* Fieber, Lotos, iii, p. 173. [Portugal.]

Rio de Janeiro. April 8, 1913. (Malcolm Burr.) Two males.

This African species, which has also been taken in Portugal, was recorded from Rio de Janeiro by Brunner.[10] The present specimens are inseparable from a pair from Kwidschwi Island, Lake Kivu, Central Africa, and agree in every particular with the description of the species. As suggested by Brunner, the species certainly found its way to America in shipping, probably through the medium of slave ships, which made very frequent voyages from West Africa to Brazil. The African cricket *Scapsipedus limbatus* was, in every probability, similarly introduced into the West Indies.[11]

[10] Monogr. der Phaneropt., p. 213, (1878).

[11] See Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1915, p. 297 footnote 7, (1915).

**Anaulacomera intermedia** Brunner

1878. *A[naulacomera] intermedia* Brunner, Monogr. der Phaneropt., pp. 278, 283. [Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One male.

The present species fully agrees with the original description of this very distinct species. Bruner[12] has recorded a male of the form from Rio de Janeiro.

## Copiphorinae

**Neoconocephalus virescens** Karny

1907. *Neoconocephalus virescens* Karny, Abhandl. k.-k. zool.-botan. Gesell. Wien, iv, heft iii, pp. 22, 29. [Marcapata, Peru.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One male.

This specimen fully agrees with the brief description of Karny, and also with his measurements. It is possible that it may represent a distinct species, as the two localities are so widely separated, but we have no valid reason at present to consider the Petropolis male as other than *virescens*.

**Neoconocephalus irroratus** (Burmeister)

1838. *C[onocephalus] irroratus* Burmeister, Handb. der Entom., ii, abth. ii, pt. i, p. 705. [Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Five males, two females.

These specimens fully agree with the description of this species given by Redtenbacher, except for one feature, which is the absence of black areas at the base of the spines on the median femora. We find, from the present material, that these areas may or may not be indicated, and in certain specimens mere shadowy indications of the blackish patches are evident. There can be no question of the specific identity of the individuals with or without these markings. Four of the males show distinct blackish points on the tegmina, the other specimens have no indications of these. The size variation is very great, the extremes of each sex being as follows (measurements in millimeters):

[12] Ann. Carneg. Mus., ix, p. 319, (1915).

| | Length of body | Length of pronotum | Greatest caudal width of pronotum | Length of tegmen | Length of caudal femur | Length of ovipositor |
|---|---|---|---|---|---|---|
| ♂ | 25 | 7.6 | 5.2 | 35.8 | 20 | .. |
| ♂ | 30 | 9.2 | 6.1 | 42.4 | 24.5 | .. |
| ♀ | 31.9[13] | 7.9 | 5.2 | 46 | 24 | 30 |
| ♀ | 35.2[13] | 8.3 | 5.4 | 44.5 | 26.9 | 29 |

We have not used DeGeer's name *tuberculatus* for this species, as has been done by several recent authors, because it seems evident to us that DeGeer had a very different species, and probably one of another genus before him. Stål,[14] in commenting on the DeGeerian material says the fastigii touch in the type of the species. This would show it to be quite distinct from *irroratus* and probably from *Neoconocephalus*.

### Conocephalinae

**Conocephalus saltator** (Saussure)[15]

1859. *X[iphidium] saltator* Saussure, Revue et Magasin de Zoologie, 2e ser., xi, p. 208. [Guiana.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Eight males, five females, one immature female.

**Conocephalus truncatus** (Redtenbacher)[16]

1891. *Xiphidium truncatus* Redtenbacher, Verh. k.-k. zool.-botan. Gesell. Wien, xli, p. 522. [Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One female.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Six males, ten females.

## GRYLLIDAE

### Gryllinae

**Hygronemobius dissimilis** (Saussure)

1874. *Nemobius dissimilis* Saussure, Miss. Sci. Mexiq., Réch. Zool., vi, p. 387. [Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Two males.

[13] Exclusive of ovipositor.

[14] Recens, Orthopt., ii, p. 110, (1874).

[15] Recorded by Rehn and Hebard, Trans. Amer. Entom. Soc., xlii, p. 278, (1915).

[16] Recorded by Rehn and Hebard, Trans. Amer. Entom. Soc., xlii, p. 281, (1915).

These specimens have been recorded by Hebard in his study of the genus.[17]

**Gryllus assimilis** (Fabricius)

1775. [*Acheta*] *assimilis* Fabricius, Syst. Entom., p. 280. [Jamaica.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) One female.[18]

TRIGONIDIINAE

**Anaxipha pallens** (Stål)

1860. *Trigonidium pallens* Stål, Kong. Svenska Fregatt. Eugenies Resa, Insecta, p. 318. [Rio de Janeiro, Brazil.]

Tijuca. April 9 to 11, 1913. (Malcolm Burr.) Sixteen males, eleven females.

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Nine males, eight females, one immature female.

The series is clearly referable to Stål's *pallens*, which seems to have been unrecognized since the original description. The latter is quite brief, but its features are fully apparent in this quite extensive series.

The specimens have been dried after immersion in liquid preservative, and in consequence their color tones have been much altered, but the pattern is clearly apparent and as described.

An examination of the material for the character of the perforation of the cephalic tibiae shows that all[19] have the tibiae biperforate. Two males and one female from Tijuca and one of each sex from Petropolis have the wings caudate; the more usual condition, and that described by Stål, has them completely hidden under the tegmina, than which the wings are distinctly, though somewhat variably, shorter. The size varies very considerably, from faintly under to appreciably over Stål's dimensions.

**Symphyloxiphus abbreviatum** (Bruner)

1916. *Cyrtoxipha abbreviata* Bruner, Ann. Carneg. Mus., x, p. 408. [Chapada, Matto Grosso, Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) Two females.

[17] Entom. News, xxvi, p. 197, (1915).

[18] This specimen has been recorded by Rehn and Hebard in a study of the American representatives of the genus (Proc. Acad. Nat. Sci. Phila., 1915, p. 319, (1915)).

[19] Two specimens have no cephalic limbs.

These specimens agree quite well with the original description of this species, which will fall more naturally into *Symphyloxiphus*[20] than into *Cyrtoxipha* or *Anaxipha*. The tegmina are of the type found in the female of *Symphyloxiphus*, with the veins somewhat more elevated but of similar direction and disposition, while the distal palpal joint is more of the type of *Anaxipha*. The form of the proximal antennal joint is, however, much like that of the genotype. It would seem that *S. magnificum* Rehn, the genotype, shows a number of features of decided difference from *Anaxipha*, and even more from *Cyrtoxipha*, but that certain other species, among them *abbreviatum*, to a degree bridge this gap. We feel the affinity of these forms is more properly expressed by ranging them with *magnificum*, although in certain features they are less divergent from *Anaxipha* than is *S. magnificum*. Without males we can not make the full comparisons we should like.

**Symphyloxiphus pulex** new species (Pl. XXVII, figs. 7, 8 and 9.)

Closely related to *S. abbreviatum* (Bruner), agreeing in the general form, but differing in the proportionately broader interantennal portion of the rostrum, the shorter and broader pronotum, the more quadrate lateral lobes of the pronotum, the more regularly disposed and less numerous dorsal tegminal venation of the female, and in the shorter and relatively more robust ovipositor and caudal femora. When compared with *S. magnificum* Rehn, this species is readily distinguishable by its shorter distal palpal joint, its broader pronotum, shorter cephalic limbs, more sparsely and more strongly venose tegmina, more robust and inflated caudal femora, in the shorter and more robust ovipositor, as well as the non-strigate external face of the caudal femora. From *bicolor* (Chopard)[21] the new form apparently differs in the same features as from *magnificum*.

Type.—♂; Petropolis, State of Rio de Janeiro, Brazil. April 12 to 14, 1913. (Malcolm Burr.) [Acad. Nat. Sci. Phila., Type no. 5339.]

[20] Rehn, Proc. U. S. Nat. Mus., xxx, p. 603, (1906). [Genotype: *S. magnificum* Rehn, from Costa Rica.]

[21] Vide infra.

Size small: form robust, compact, puliciform: surface of all exposed parts, excepting the tegmina, covered to a greater or lesser degree with short, adpressed hairs. Head short, strongly transverse, its greatest depth subequal to the width across eyes: occiput rather strongly declivent ventro-cephalad, the least interocular width faintly greater than the greatest width of the eye, shallow, paired juxta-ocular depressions situated at the point of least width: interantennal portion of rostrum relatively broad, nearly subequal in width to the proximal antennal joint, rounded transversely and strongly arcuate when seen from the side: infra-antennal portion of face strongly transverse: palpi moderately slender and elongate, third and fifth joints subequal in length, the former weakly arcuate, the latter strongly tubiform and with its distal margin transversely truncate, the distal width of the fifth joint contained about two and one-fourth times in the length of the same; fourth joint two-thirds as long as the fifth: eyes in basal outline broad subreniform ovoid, their depth about twice that of the infra-ocular portion of the genae, when seen from the dorsum the eyes are quite prominent and directed moderately cephalad: antennae more than twice as long as the body, proximal joint large, broad; second joint hardly thicker than the succeeding ones, which are covered moderately closely with adpressed hairs and with scattered erect hairs. Pronotum with its form transverse when seen from the dorsum, the greatest caudal width contained almost twice in the greatest length, strongly narrowing cephalad, the greatest cephalic width equal to about three-fifths of the caudal width: cephalic and caudal margins of disk subtruncate, the disk very broadly rounding ventro-laterad into the lateral lobes: surface of disk with a distinct mediolongitudinal impressed sulcus on cephalic half of disk, the median region of the disk with, in addition, a poorly defined impressed triangular area: lateral lobes subquadrate in form, faintly deeper than long, the ventral angles well rounded, the ventral portion of the lobes bent ventro-mesad toward the coxae. Tegmina surpassing the apex of the abdomen by nearly the dorsal length of the pronotum, relatively broad, the greatest width of the dorsal field contained slightly more than twice in the length of the same: dorsal venation as shown in figure. Wings aborted. Subgenital plate narrowing distad, the apex bisarcuate emarginate: cerci elongate, tapering, surpassing the apices of the tegmina, strongly and thickly hirsute. Cephalic and median femora moderately robust: cephalic tibiae subequal to the femora, hardly at all fusiform, straight, rather slender; cephalic face imperforate, caudal face with a distinct elliptical foramen: proximal joint of cephalic tarsi very robust, nearly as deep as the tibiae. Caudal femora in length approximately subequal to the tegmina, moderately compressed, in general form rather strongly inflated, tapering to a relatively slender apex: caudal tibiae subequal to the femora in length, slender, armed with three pairs of marginal spurs, which are very elongate, slightly unguiculate distad, diverging from the axis of the tibia at an angle of about 35°, external distal spurs very small, the median one nearly twice the length of the ventral one, distinctly more than twice the length of the dorsal one; internal distal spurs two in number, ventral one very long, two-thirds as long as the metatarsus, subfusiform, dorsal one two-thirds as long as the ventral one, tapering: caudal metatarsi subequal to the length of the remaining joints of the tarsus, relatively heavy, weakly compressed,

disto-internal spur two-thirds as long as the metatarsus, second joint of tarsus elongate-elliptical in outline.

Allotype.— ♀ ; Tijuca, Rio de Janeiro, Brazil. April 9 to 11, 1913. (Malcolm Burr.) [Acad. Nat. Sci. Phila.]

Differing from the above description of the type in the following features. Pronotum less strongly transverse, the caudal width not more than one-third again as great as the length, with the cephalic narrowing less pronounced, more nearly quadrate. Tegmina falling short of the apex of the abdomen by about one-third of their length, when closed and seen from above rectangulate in form, the greatest width of the dorsal field of the single tegmen contained more than twice in the tegminal length: costal margin strongly arcuate proximad, faintly arcuate-emarginate mesad, thence broadly and gradually arcuate to the rotundato-truncate apex of the dorsal field; sutural margin nearly straight: venation pronounced, elevated; of the dorsal field regular, composed of six longitudinal veins, with about four intercalated false nervures, all connected by a variable number of cross-nervures; of lateral field composed of the straight mediastine vein and three supplementary nervures, the first marginal and strongly sinuate, the second brief and incomplete, the third parallel to and equally developed with the mediastine vein. Ovipositor faintly longer than the cephalic femur, moderately falciform, slightly more so proximad than elsewhere, division of valves at three-fifths of length from base, apex strongly acuminate, dorsal and ventral margins and contiguous margin of dorsal valves finely serrulate: subgenital plate short, subrostrate. Caudal tibiae with all spurs more elongate than in the male, the proportions of the distal ones to the metatarsus and each other remaining the same, the ventro-internal one more tapering: caudal metatarsus more elongate and slender, distinctly longer than the remaining tarsal joints, disto-internal spurs hardly more than one-half as long as the metatarsus.

All of the material of this species before us either has been immersed in alcohol, and therefore has a coloration clearly not that of nature, or is so badly damaged that the color of certain portions of the body cannot be ascertained on account of their absence. The following color description is therefore a purely composite one, drawn from the entire series. Pronotum, genae, face, cephalic and median femora except for narrow, pale, distal sections, and the proximal half (♀) or all (♂) of the abdomen, blackish brown. Tegmina of the female of the same color. The tegmina of the male, the distal portion of the abdomen in the female, the caudal femora, the extremities of the cephalic and median femora, and all of the tibiae and the tarsi except as qualified as below, warm buff to ochraceous-buff. The head has the occiput pale, to a greater or lesser degree with fuscous, which generally resolves itself into a quadrilineate pattern; eyes margined caudad, ventrad and occasionally dorsad with pale, a pale infraocular line on the genae indicated; eyes hair brown to cinnamon brown; antennae pale with the proximal joint infuscate; palpi very pale, the distal joint marked distad more or less distinctly with fuscous. Ovipositor of female pale, ferruginous washed distad. Caudal femora with a fine dorsal and another

external line of fuscous, these often subobsolete, the genicular arches occasionally blackish-brown; caudal tibiae with or without points of blackish-brown at the base of each marginal spur; caudal tarsi similarly with or without the entire second and apex of third joint blackish-brown. A single pair from Tijuca have a very recessive type of coloration, the pronotum in both sexes and the tegmina in the female as well being yellow ocher.

♂ (*type*): length of body, 5 mm.; length of pronotum, 1.2; greatest (caudal) width of pronotum, 2.1; length of tegmen, 4.1; greatest width of dorsal field of tegmen, 2.2; length of caudal femur, 4.2.

♀ (*allotype*): length of body, 5.2 mm.; length of pronotum, 1.2; greatest width of pronotum, 1.5; length of tegmen, 3.1; greatest width of dorsal field of tegmen, 1.4; length of caudal femur, 5; length of ovipositor, 1.8.

In addition to the type and allotype we have examined six paratypes (three males and three females) from the same general region and the same collection. These were taken at Petropolis (1 ♂, 1 ♀) and Tijuca (2 ♂, 2 ♀) on the dates given above for the type and allotype. As we have said above under color comments, all the material has been injured through color change or breakage of parts. In addition to these we have before us five females from La Piedrita, Venezuela, taken February 16, 1911 (S. Brown), and a single female from Pará, state of Pará, Brazil (C. F. Baker), in the collection of the Academy. This material from Venezuela and northern Brazil shows certain features of difference, as somewhat shorter form, more robust palpi and apparent color tendencies, which may make it necessary at a future date, when more and perfect material is at hand, to separate the more northern insects, but for the present it seems best to permit them to remain under *pulex*. We do not, however, consider them paratypes of the new species. In the allotypic female we find four external marginal spurs on one caudal tibia,[22] all the other specimens have three. In all the material the perforation of the cephalic tibiae is as described, and in none are the wings developed.

The genus *Symphyloxiphus* also contains the two species described from western Ecuador by Chopard as *Anaxipha riveti* and *A. bicolor*.[23] The latter is clearly a member of the present genus, extremely close to, if distinct from, *S. magnificum* (the genotype), and we have no hesitation in assigning it without

[22] This specimen has but a single caudal limb remaining.

[23] Miss. Serv. Geogr. pour Mesure Arc Mérid. Equat. Amér. Sud., x, fasc. i, pp. 49 to 50, pls. v, fig. 6, vi., figs. 7, 8, 13, 15 and 16.

material. Of *riveti*, however, we have before us a series of two males and thirteen females, taken at Duran, Ecuador, June 23 and 28, 1914 (H. S. Parish), and two males and one female from Lima, Peru, August 12 and 19 and September 2, 1914 (same collector), all in the collection of the Academy. The species *riveti* is typical *Symphyloxiphus* in palpal proportions, in the general contour of the cephalic femora and in tegminal structure, as well as in the pattern of limb coloration. Our material demonstrates that macropterism occurs in the genus, all of the Duran material having caudate wings, while the Lima specimens have the wings atrophied. Correlated with this, as found to be the case in *Anaxipha*, all the macropterous specimens have the cephalic tibiae strongly elliptico-perforate on both faces, while those with atrophied wings have the foramina on the cephalic face greatly reduced or subobsolete. The type material of Chopard, which was of the latter type, was described as having the tibiae perforate only on the caudal face.

The following tentative key to the species which we would refer to *Symphyloxiphus*, may assist in the recognition and discimination of the species. As we have said above, *bicolor* may not be distinct from *magnificum*, but on this point we cannot make a definite statement, as it is the only one of the species here assigned of which we have examined no material.

A. Distal palpal joint hardly, if at all, longer than the third joint, regularly tubiform (distal margin transversely truncate). Caudal femora with one or more longitudinal lines of black on external face. Cephalic tibiae straight, more slender.

B. Pronotum weakly transverse. Tegmina of female with less regularly disposed and more numerous veins in dorsal field. Caudal femora slender. Ovipositor slender and more elongate. Cephalic and median femora not largely black. **abbreviatum** (Bruner)

BB. Pronotum strongly transverse. Tegmina of female with more regularly disposed and more numerous veins in dorsal field. Caudal femora relatively robust. Ovipositor robust and shorter. Cephalic and median femora largely black. **pulex** new species

AA. Distal palpal joint distinctly longer than the third joint, elongate tubiform. Caudal femora without longitudinal black lines on external face. Cephalic tibiae as a whole gently arcuate, heavy.

B. Tegmina ochraceous, more or less marked with brownish, particularly on lateral field. Pronotum with the lateral lobes crossed by a broad black line. **riveti** (Chopard)

BB. Tegmina shining black, veins rather poorly indicated. Pronotum without broad black line on lateral lobes.

C. Head orange-ochraceous. Caudal femora without dorsal black line. **magnificum** Rehn

CC. Head black. Caudal femora with dorsal black line. **bicolor** (Chopard)

**Phylloscyrtus colliurides** (Stål)

1860. *Cranistus colliurides* Stål, Kongl. Svenska Freg. Eugen. Resa, Insecta, p. 316, pl. v, fig. 5. [Rio de Janeiro, Brazil.]

Petropolis. April 12 to 14, 1913. (Malcolm Burr.) One male, one female.

These specimens clearly represent this interesting species, which has been subject to some vicissitudes in its interpretation in the past. We know little concerning the extent of its distribution and almost nothing about its color variations. The present specimens have the pronotum colored exactly as in *P. canotus*, a specimen of which is also before us, but *colliurides* differs in being larger, with solidly colored tegmina and much more decidedly projecting wings. Stål, in the original description, refers to the subchitinous exposed portions of the wings as cerci, saying also, "alae nullae," a pardonable error, for such it is the figure demonstrates. Saussure[24] has added a touch of confusion to this species by giving 20.5 mm. as the length, an evident error for 9.5 or 10.5, as the remainder of the measurements would show. Stål gives the length as $9\frac{1}{2}$ mm.

The figure given by Burmeister as *colliurides*[25] does not represent the species as we understand it from the above, practically topotypic, material.

[24] Mel. Orthopt., ii, fasc. vi, p. 640 (1878).

[25] Abhandl. Gesell. Halle, xv, p. 12, (1880).

## Explanation of Plate XXVII

Fig. 1.—*Hypnornoides burri* new genus and species. *Type.* (× 7)
Fig. 2.—*Hypnornoides burri* new genus and species. Cephalic aspect of head. *Type.* (Greatly enlarged.)
Fig. 3.—*Chorisoneura bisignata* new species. Tegmen of *type.* (× 7)
Fig. 4.—*Chorisoneura bisignata* new species. Pronotum of *type.* (× 7)
Fig. 5.—*Chorisoneura bisignata* new species. Anterior field of wing of *type.* (× 7)
Fig. 6.—*Chorisoneura bisignata* new species. Ventral surface of apex of abdomen of male (*type*). (Greatly enlarged.)
Fig. 7.—*Symphyloxiphus pulex* new species. Dorsal view of head and tegmina of male (*type*). (× 9)
Fig. 8.—*Symphyloxiphus pulex* new species. Palpus of *type.* (Greatly enlarged.)
Fig. 9.—*Symphyloxiphus pulex* new species. Ovipositor of female (*allotype*). (Greatly enlarged.)

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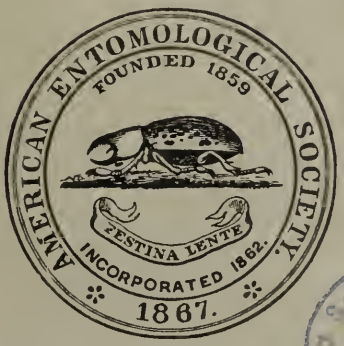


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# NEW SPECIES OF NORTH AMERICAN BEES OF THE GENUS ANDRENA

## CONTAINED IN THE COLLECTIONS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

BY HENRY L. VIERECK

The following descriptions are contributions toward a monograph of the Pan-American species of *Andrena*.

The proportions are in terms of divisions of a disc micrometer with 10 divisions to 1 mm., used in a Spencer Lens Company binocular with 10X Spencer ocular and 40 mm. Spencer objective; each division appears to equal 42 $\mu$.

**Andrena (Andrena) abacta**[1] new species

*Type*.—No. 4060, The Academy of Natural Sciences of Philadelphia. Type locality.—Texas. (No. 5, Belfrage?)

Related to *A.* (*A.*) *nigrae* Robertson and *A.* (*A.*) *salictaria* Robertson. It may prove to be a race of the latter species.

Female.—Length 8 mm.; **body** greenish, mostly covered with whitish hairs; **head** with its facial line: transfacial line :: 43: 51, axial line : temporal line :: 21 : 10, malar line : joint 3 of antennae :: 1 : 6, ocelloccipital line : greatest diameter of lateral ocellus :: 4: 4, elevated portion of malar space virtually wanting, head covered with whitish hairs, front greenish and rather finely, longitudinally striate, not elevated into a welt along the fovea, fovea at most: ocellocular line :: 6:9, foveal band wanting at upper end of the inner eye margin, distance between fovea and ocelli : ocellocular line :: 2.5: 9, fovea attenuated below its middle where it is apparently only one-half or a little more than half as wide as the greatest width of the fovea, the latter continued to a point apparently a little below the antennal line, fovea filled with pale golden hairs, fovarea represented by a beveled shiny space, face shiny, partly indistinctly reticulate, with indistinct punctures that are as many as four puncture widths apart, clypeus brownish, slightly elevated above the apical margin, almost planate, sculptured like the face except that the punctures are larger and better defined, clypearea present but poorly defined, clypeus thinly hairy its sculpture not at all hidden by hairs, labrarea nearly semicircular in outline, its width at base : length down the middle :: 7: 2, labrarea at base apparently a little more than half as wide as the labrum, the latter with a fringe of pale golden hairs, labrum without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 6: 5, joint 4 and 5 thicker than long, the

[1] This specific name was proposed for this species by Prof. W. M. Davis.

succeeding joints from distinctly thicker than long to slightly thicker than long, except joint 12 which is distinctly longer than thick, antennae blackish brown throughout, mandibles typical, robust, extending to the outer edge of the labrarea, black except for the apical third which is clear dark reddish, palpi nearly typical; **thorax** covered with an abundance of whitish hairs which are shorter on the dorsulum than on the mesopleura, dorsulum dullish, greenish and purplish, finely reticulated and sparsely punctured, the punctures wider apart than on the clypeus, notauli represented by a shiny line, mesopleura sculptured much like the dorsulum but not so closely or distinctly punctured, scutel shiny, hairy, colored and sculptured much like the dorsulum but feebly so, metanotum hairy and sculptured and colored like the dorsulum except that the sculpture is denser and less distinct, tegulae pale yellowish stramineous, polished, wing base dull yellowish stramineous, subcosta brownish, stigma pale yellowish stramineous, rest of veins almost concolorous with the stigma but not so yellowish, the wing hairs pale golden, first recurrent vein received by the second submarginal cell before the middle and a little more than twice as far from the first transverse cubitus as the latter is to the stigma on the radial vein, nervulus not interstitial, received by the median cell and forming an acute angle with the second abscissa of the median vein, membrane with a uniformly yellowish tinge, nearly colorless, legs dark brown except for the tarsi and hind tibiae which are more or less yellowish stramineous, legs covered with pale hairs, scopa typical, its hairs whitish throughout, hind metatarsi at most apparently a little wider than the mid metatarsi; **propodeum** with its enclosure poorly defined, shiny and rather coarsely sculptured on its upper aspect, finely reticulated on its hind aspect, rest of upper face of propodeum sculptured somewhat like the mesopleura but seemingly impunctate, and covered with finer hair, propodeal pleura shiny, finely reticulated, with a few scattered shallow punctures; **abdomen** brownish with a slight greenish tinge, with its tergum shiny and sculptured much like the sides of the propodeum but with smaller inconspicuous punctures, the punctures from two to six or more puncture widths apart on the first tergite, the punctures hardly closer on the succeeding tergites, second, third and fourth tergites with an apical, whitish hair band that is interrupted in the middle of the second and third, apical edge of first, second, third and fourth tergites with a pale stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 14: 6, fifth tergite shining, reticulate, its punctures distinct and closer together than on the other tergites, pygidium nearly planate, somewhat concave, reticulate, narrowly truncate at apex, tergum with inconspicuous pale, nearly erect hairs in addition to the hair bands, fimbria pale golden.

**Andrena** (**Andrena**) **albiculta**[2] new species

*Type*.—No. 4045, The Academy of Natural Sciences of Philadelphia. Type locality.—Southern California. (H. K. Morrison.)

Related to *A*. (*A*.) *decussata* Viereck.

[2] The above specific name was proposed for this species by Prof. W. M. Davis.

Female.—Length 10.5 mm.; **body** black, mostly covered with pale ochreous, almost white hairs; **head** with its facial line : transfacial line :: 70 : 82, axial line : temporal line :: 30 : 13, malar line : joint 3 of antennae :: 1 : 11, ocelloccipital line : greatest diameter of lateral ocellus :: 7: 6, elevated portion of malar space represented by a shining line, head covered with whitish and dark or blackish hairs, front rather distinctly longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 8: 15, foveal band present and at upper end of the inner eye margin : ocellocular line :: 2: 15, distance between fovea and ocelli: ocellocular line :: 5: 15, fovea deep at its upper end, nearly parallel-sided, seemingly a little narrower above its middle than below its middle, the latter continued to a point apparently a little above the antennal line, fovea filled with pale brownish hairs on its upper half, with whitish hairs on its lower half, vertex and temples along the upper edge of the eye with dark hairs, face dark brown, mostly finely reticulated, with indistinctly defined punctures of two sizes that are as many as four puncture widths apart, supraclypeal area dark reddish brown, clypeus slightly elevated above the apical margin, convex, sculptured like the face except that the punctures are larger and better defined and as many as six puncture widths apart, clypearea wanting, clypeus thinly hairy with black or blackish hairs, its sculpture not at all hidden by hairs, labrarea narrowly subemarginate, its width at base : length down the middle :: 15: 4, width at apex : length down the middle :: 2: 4, greatest length : width at base :: 4.5: 15, labrarea at base nearly two-thirds as wide as the labrum, the latter with a fringe of golden brown hairs, labrum without a median longitudinal crista but finely reticulated between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 11: 11, joints 4 to 9 thicker than long, the succeeding joint as thick as long, joint 11 a little longer than thick, joint 12 distinctly longer than thick, antennae blackish brown throughout, mandibles typical, robust, extending to the outer edge of the labrarea, black except for the apical half which is more or less dark reddish, palpi nearly typical; **thorax** covered with an abundance of whitish hairs which are as long on the dorsulum as the whitish hairs on the mesopleura, dorsulum dullish, finely reticulated and punctured, the punctures nearly hidden by the hairs, from one to two puncture widths apart, notauli represented by a shiny line, anterior aspect of mesopleura with blackish hairs like the mesosternum, sculptured somewhat like the dorsulum but not so closely punctured, mesopleura not hidden by the sparse hairs, scutel hairy and sculptured much like the dorsulum laterally, its disc on each side nearly polished, metanotum hairy and sculptured much like the dorsulum except that the sculpture is denser and less distinct, tegulae dark brown, polished, wing base partly blackish brown, subcosta blackish brown, stigma pale brownish stramineous, rest of veins dull stramineous, with a blackish tinge, first recurrent vein received by the second submarginal cell before the middle and nearly as near to the first transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly tinged with brown, legs blackish brown except for the claws which are more or less pale brown, legs covered with blackish

brown or black hairs, scopa nearly typical, its hairs blackish throughout and at most only as long as the greatest width of the hind tibiae, hind metatarsi at most : mid metatarsi :: 13: 16; **propodeum** with its enclosure well defined, dullish and finely reticulated, finely regulose and with vestigial ridges at base, rest of upper face of propodeum sculptured somewhat like the mesopleura but not so shiny nor so distinctly punctured, and covered with fine whitish hair, propodeal pleura with sparse shallow punctures and dark hairs and almost hidden by the whitish floccus; **abdomen** blackish brown with its tergum shiny and finely sculptured, the punctures fine and from two to six puncture widths apart on the first tergite, the punctures closer on the succeeding tergites, second, third and fourth tergites without an apical hair band, apical edge of first, second, third and fourth tergites with a brownish stramineous border, second tergite with its elevated portion down the middle: depressed portion :: 21: 10, fifth tergite shiny, reticulate, its punctures coarser than on the other tergites, pygidium slightly convex, without a shallow furrow on each side, rounded at apex, tergum covered with inconspicuous dark hairs, fimbria dark seal brown.

**Andrena (Andrena) angustitarsata huardi** new race

*Type.*—No. 4051, The Academy of Natural Sciences of Philadelphia. Type locality.—California. (No further data.)

Female.—Differs from typical *A.* (*A.*) *angustitarsata* Viereck only in the ochreous color of its pubescence.

**Andrena (Andrena) argentiscopa** new species

*Type.*—No. 4044, The Academy of Natural Sciences of Philadelphia. Type locality.—California. (E. Norton.)

Related to *A.* (*A.*) *bisalicis* Viereck.

Female.—Length 7 mm.; **body** black, mostly covered with whitish hairs; **head** with its facial line : transfacial line :: 45: 57, axial line : temporal line :: 23: 12, malar line : joint 3 of antennae :: 1.5: ?9, ocelloccipital line : greatest diameter of lateral ocellus :: 4: 4, elevated portion of malar space nearly wanting, front rather finely, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 5: 10, foveal band represented by a shining line at upper end of the inner eye margin, distance between fovea and ocelli: ocellocular line :: 6: 10, fovea slightly attenuated below its middle where it is nearly as wide as the greatest width of the fovea, the latter continued to a point far below the clypeal line, fovea filled with pale cacao brown hairs, on its upper half, with pale ochreous hairs on its lower half, face dullish, finely reticulate, with indistinct punctures that are as many as three or four puncture widths apart, clypeus trenchantly elevated above the apical margin, slightly convex, sculptured like the face except that the punctures are larger and better defined, clypearea apparently wanting, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea narrowly truncate its width at base : length down the middle :: 8: 4, width at apex : length down the middle :: 3: 4, labrarea at base nearly half as wide as the labrum, the latter with a fringe of pale golden hairs, labrum with a median longitudinal crista between the labrarea and the apical edge of labrum, joint 3 of antennae probably : 4+5 :: 9: 8, joints

4 and 5 probably thicker than long, the succeeding joints probably as thick as long or little longer than thick except perhaps joints 11 and 12 which are probably distinctly longer than thick, antennae probably blackish throughout, mandibles typical, robust, extending to the outer edge of the labrarea, black except for the apical half which is mostly dark reddish, palpi nearly typical; **thorax** covered with an abundance of whitish hairs which are much shorter on the dorsulum than the almost whitish hairs on the mesopleura, dorsulum dullish, finely reticulated and punctured like the face, notauli represented by an impressed line, mesopleura with whitish hairs, sculptured somewhat like the dorsulum but not so distinctly, scutel hairy and sculptured much like the dorsulum but more shiny, metanotum mostly finely rugulose, dullish, tegulae dark brown, polished, wing base partly blackish brown, subcosta blackish brown, stigma pale yellowish stramineous, rest of veins dull stramineous, with a blackish tinge, first recurrent vein received by the second submarginal cell a little before the middle and apparently one and one-half times as far from the first transverse cubitus as the first transverse cubitus is from the stigma on the radial vein, nervulus almost exactly interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly tinged with brown, legs blackish brown throughout, legs covered with brownish golden and whitish hairs, scopa typical, its hairs mostly silvery, hairs at base above decidedly darkened, hind metatarsi at most apparently a little narrower than mid metatarsi; **propodeum** with its enclosure poorly defined, dullish and finely reticulated, with short ill defined ridges at extreme base, rest of upper face of propodeum sculptured somewhat like the mesopleura and covered with pale whitish hair, propodeal pleura finely reticulated, with sparse shallow punctures, floccus whitish; **abdomen** with its tergum shiny, finely reticulated and indistinctly punctured, the punctures from two to six or more puncture widths apart on the first tergite, the punctures somewhat closer on the succeeding tergites, second, third and fourth tergites with a thin, apical, whitish hair band that is broadly interrupted in the middle of the second and third tergites, first, second, third and fourth tergites with the depressed margin brownish edged with pale stramineous, second tergite with its elevated portion down the middle : depressed portion :: 11 : 7, fifth tergite shiny, reticulate, its punctures coarser than on the other tergites, pygidium nearly planate, with a shallow furrow on each side, truncate at apex, brownish, tergum with inconspicuous pale hairs, in addition to the hair bands, fimbria pale golden.

**Andrena (Andrena) barbarica**[3] new species

*Type*.—No. 4065, The Academy of Natural Sciences of Philadelphia. Type locality.—Tazewell, Virginia, June 10, 1915. (L. O. Jackson.)

Related to *A. (A.) integra* Smith.

Female.—Length 9 mm.; **body** black, mostly covered with pale ochreous almost white hairs, **head** with its facial line : transfacial line :: 52 : 63, axial line : temporal line :: 27 : 16, malar line : joint 3 of antennae :: 1 : 8, ocelloc-

[3] This is Prof. W. M. Davis' name for this species.

cipital line : greatest diameter of lateral ocellus :: 4: 4, elevated portion of malar space virtually wanting, head covered with whitish hairs, front rather distinctly longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 5: 12, foveal band present and at upper end of the inner eye margin : ocellocular line nearly :: 2: 12, distance between fovea and ocelli : ocellocular line :: 4: 12, fovea slightly attenuated below its middle and continued to a plane apparently near the clypeal line, fovea filled with pale ochreous, nearly white hairs, fovarea wanting, vertex and temples along the upper edge of the eye with pale hairs, face shiny, partly indistinctly reticulate, with distinct punctures of various sizes that are from nearly adjoining to as many as five puncture widths apart, lowermost portion of face with a sculptureless polished margin, clypeus slightly elevated above the apical margin, convex, finely reticulated, shiny and punctured, the punctures more nearly uniform, mostly as large or larger than the largest punctures on the face and mostly from three to five puncture widths apart, clypearea present but poorly defined, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea truncate, its width at base : length down the middle :: 10: 5, width at apex : length down the middle :: 5: 5, labrarea at base : distance between lower corners of clypeus :: 10: 19, labrum with a fringe of dark golden hairs and without a median longitudinal crista between the labrarea and its apical edge, joint 3 of antennae : 4+5 :: 8: 7, joints 4 and 5 thicker than long, the succeeding joints as thick as long or a little longer than thick except joints 11 and 12 which are distinctly longer than thick, antennae blackish except that the flagel is coffee brown beneath, mandibles typical, robust, extending to near the outer edge of the labrarea, black except for the apical fourth which is mostly dark reddish, palpi nearly typical; **thorax** thinly covered with pale ochreous, almost white or white hairs which are shorter on the dorsulum where they are darker than the almost white hairs on the mesopleura, dorsulum shiny, finely reticulated and punctured like the face but more distinctly so, notauli represented by an impressed shiny line, middle of the posterior half of the dorsulum nearly polished, mesopleura with almost white hairs, sculptured somewhat like the dorsulum but not so sparsely or distinctly punctured, scutel almost bare and mostly impunctate and polished, metanotum hairy and densely, indefinitely, sculptured, tegulae blackish and pale stramineous, partly almost polished, wing base partly blackish brown, subcosta blackish brown, stigma dark brownish stramineous, rest of veins dull stramineous, first recurrent vein received by the second submarginal cell beyond the middle and distinctly nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus not interstitial and forming an acute angle with the second abscissa of the median vein, membrane with a uniform yellowish brown tinge, legs blackish except for the tarsi which are more or less dark brownish stramineous, legs covered with pale ochreous and whitish hairs except for the dark ochreous and brownish hairs on parts of the tarsi and tibiae, scopa typical, pale ochreous, almost white except for the hairs at base above which are decidedly darkened, hind metatarsi at most as wide as the mid metatarsi; **propodeum** with its enclosure apically well, basally poorly defined, its upper aspect rather coarsely wrinkled and shiny, its hind aspect rather finely reticulated, rest of upper face

of propodeum sculptured like the upper aspect of the enclosure and covered with fine whitish hair, propodeal pleura partly impunctate, mostly with sparse indefinite shallow punctures, propodeal floccus thin and pale ochreous; **abdomen** with its tergum shiny and sculptured much like the temples except that the first and second tergites are nearly polished, the punctures mostly from three to eight puncture widths apart on the first tergite, the punctures closer together on the succeeding tergites, second, third, and fourth tergites with a thin, whitish apical hair band that is interrupted in the middle of the second and third, apical edge of second, third, and fourth tergites with a stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 17: 10, fifth tergite shiny, reticulate, its punctures closer together than on the other tergites, pygidium nearly planate, with an embossed central area, nearly pointed at apex, tergum with inconspicuous, pale, appressed hairs in addition to the hair bands, fimbria pale brownish golden.

Other localities.—Indiana; Ottawa, Kansas, June 6; Texas (Belfrage).

**Andrena (Andrena) citrinihirta** new species

*Type*.—No. 4040, The Academy of Natural Sciences of Philadelphia. Type locality.—California. (E. Norton.)

Related to *A.* (*A.*) *nubecula* Smith.

Female.—Length 8.5 mm.; **body** black, covered with pale ochreous, almost lemon yellow hairs, **head** with its facial line : transfacial line :: 48: 61, axial line : temporal line :: 27: 17, malar line : joint 3 of antennae :: 1.5 : 8, ocelloccipital line : greatest diameter of lateral ocellus :: 5: 4, elevated portion of malar space nearly wanting, front rather distinctly, longitudinally striate, not elevated into a welt along the fovea, with a rather distinct median longitudinal crista, fovea at most : ocellocular line :: 7.5: 11, foveal band represented by a shining line and a nearly bare beveled area the width of which : ocellocular line :: 1: 11, distance between fovea and ocelli : ocellocular line :: 4: 11, fovea somewhat attenuated below its middle where it is apparently only a little narrower than the greatest width of the fovea, the latter continued to a point apparently a little below the antennal line, fovea filled with hairs that are concolorous with the hairs of the body, vertex and temples along the upper edge of the eye with hairs that are concolorous with the body hairs, face mostly polished, with indistinct punctures of two sizes which are as many as five or more puncture widths apart, clypeus slightly elevated above the apical margin, slightly convex, sculptured like the face except that the punctures are larger, sparser and better defined, clypearea present, polished, well defined, and on the lower half nearly half as wide as the labrarea, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea emarginate, its width at base : length down the middle :: 8: 4, width at apex : length down the middle :: 6: 4, greatest length : width at base :: 5: 8, labrarea at base nearly two-thirds as wide as the labrum, the latter with a fringe of golden hairs, labrum simple, joint 3 of antennae : 4+5 :: 9: 8, joints 4 and 5 thicker than long, the succeeding joints as

thick as long or little longer than thick except joint 12 which is distinctly longer than thick, antennae very dark brown throughout, mandibles typical, robust, worn, black except for the apical half which is dark reddish, palpi nearly typical; **thorax** covered with an abundance of pale ochreous, almost yellow hairs which are mostly shorter on the dorsulum where they are as coarse as the hairs on the mesopleura, dorsulum mostly polished or nearly so, partly finely reticulated, punctured like the clypeus but more distinctly so and more closely, notauli represented by an impressed line, mesopleura with almost yellow hairs, sculptured somewhat like the dorsulum but not so closely or distinctly punctured, scutel hairy and sculptured much like the dorsulum, metanotum hairy, its sculpture hidden by its long coarse hairs, tegulae pale brownish stramineous, finely sculptured, wing base dark brown, subcosta dark brown, stigma pale brownish stramineous and concolorous or nearly so with the rest of the veins, first recurrent vein received by the second submarginal cell in or near the middle and nearly as near to the first transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus received by the median cell and forming an acute angle with the second abscissa of the median vein, second transverse cubitus wanting in the left wing and only half developed in the right wing, membrane tinged with brown and with a dark brownish cloud at apex of the marginal cell and beyond along the anterior edge of the wing, legs dark brown except for the tarsi and the hind tibiae which are more or less paler brown, legs covered with yellowish and golden hairs, scopa typical, golden and concolorous, hind metatarsi at most distinctly narrower than mid metatarsi; **propodeum** with its enclosure poorly defined, shining and finely reticulated, rest of upper face of propodeum sculptured somewhat like the mesopleura but with smaller punctures, not so shining, and covered with finer yellowish hair, propodeal pleura nearly polished and with sparse shallow punctures and almost hidden by the yellowish floccus; **abdomen** with its tergum shining, punctured and finely reticulated, the punctures mostly from two to four puncture widths apart on the first tergite, the punctures hardly closer on the succeeding tergites, first, second, third and fourth tergites with a broad apical, yellowish hair band which is not interrupted in the middle and which occupies all of the depressed margin, apical edge of first, second, third and fourth tergites with a pale stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 14: 10, fifth tergite shining, reticulate, its punctures coarser and not so close together as on the other tergites, pygidium nearly planate, partly reddish, nearly pointed at apex, tergum with inconspicuous pale appressed hairs in addition to the hair bands except on the first and second tergites where in addition there are some nearly erect hairs, fimbria yellowish.

**Andrena (Andrena) coactipostica**[4] new species

*Type*.—No. 4037, The Academy of Natural Sciences of Philadelphia. Type locality.—Southern California (H. K. Morrison.)

Related to *A.* (*A.*) *distans* Provancher.

[4] This specific name was proposed for this species by Prof. W. M. Davis.

Female.—Length 10 mm.; **body** black, mostly covered with pale grayish hairs; **head** with its facial line : transfacial line :: 59: 75, axial line : temporal line :: 31: 20, malar line : joint 3 of antennae :: 2: 10, ocelloccipital line : greatest diameter of lateral ocellus :: 5: 4.5, elevated portion of malar space nearly wanting, head covered with grayish hairs, front rather indistinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 10: 15, foveal band virtually wanting, distance between fovea and ocelli : ocellocular line :: 5: 15, fovea somewhat attenuated below its middle where it is apparently nearly as wide as the greatest width of the fovea, the latter continued to a point apparently a little below the clypeal line, fovea filled with pale seal brown hairs on the upper half, with pale ochreous hairs on the lower half, fovarea wanting, vertex and temples along the upper edge of the eye with grayish hairs, face mostly dullish, partly indistinctly reticulate and nearly polished, with indistinctly defined punctures that are as many as five puncture widths apart, clypeus slightly elevated above the apical margin, slightly convex, sculptured like the face except that it is nowhere nearly polished, the punctures are somewhat larger and well defined, clypearea present but poorly defined, clypeus thinly hairy its sculpture not at all hidden by hairs, labrarea truncate, its width at base : length down the middle :: 12: 4, width at apex : length down the middle :: 4: 4, labrarea at base nearly two-thirds as wide as the labrum, the latter with a fringe of golden hairs, labrum without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 10: 9, joints 4 to 11 thicker than long, joint 12 distinctly longer than thick, antennae blackish throughout, mandibles typical, robust, extending to the outer edge of the labrarea, black except at the middle and at apex where they are dark reddish, palpi nearly typical; **thorax** covered with an abundance of grayish hairs which are so short on the dorsulum as to make a velvety covering, hairs of the dorsulum darker than the almost whitish long hairs on the mesopleura, dorsulum dullish, finely reticulated and punctured like the clypeus but less distinctly so and more closely punctured, notauli represented by a shining line, mesopleura with almost whitish hairs, sculptured somewhat like the face but not so closely or distinctly punctured, scutel nearly bare, hairy and sculptured much like the dorsulum but more densely so, metanotum hairy and sculptured like the scutel except that the sculpture is still denser and less distinct, and the hair less conspicuous, tegulae dark brown, polished, wing base partly blackish brown, subcosta blackish brown, stigma pale brownish stramineous, rest of veins dull stramineous, with a blackish tinge, first recurrent vein received by the second submarginal cell in the middle, and nearly as near to the second transverse cubitus as the first transverse cubitus is to the second transverse cubitus on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly tinged with brown, legs blackish except for the claws which are more or less brownish stramineous, legs covered with grayish hairs, scopa typical, its hairs almost white, hairs at base above decidedly darkened, hind metatarsi at most apparently a little wider than mid metatarsi; **propodeum** with its enclosure poorly defined, dull-

ish and finely reticulated except down the middle of its basal half where it is somewhat rugulose, rest of upper face of propodeum sculptured somewhat like the mesopleura but duller, and covered with finer grayish hair, propodeal pleura reticulated, nearly polished, with sparse shallow punctures and nearly hidden by the almost white floccus; **abdomen** with its tergum shining, punctured and indistinctly reticulate, the punctures from nearly adjoining to three puncture widths apart on the first tergite, the punctures hardly sparser on the succeeding tergites, second, third and fourth tergites with an apical, whitish hair band that is interrupted in the middle of the second and third tergites, apical edge of first, second, third and fourth tergites with a pale stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 20: 9, fifth tergite shining, indistinctly reticulate, its punctures not so close together as on the other tergites, pygidium slightly convex, without a shallow furrow on each side, nearly pointed at apex, indefinitely sculptured, tergum with inconspicuous, pale, appressed hairs, in addition to the hair bands, fimbria pale golden brown.

**Andrena** (**Andrena**) **columbiana** new species

*Type*.—No. 4038, The Academy of Natural Sciences of Philadelphia. Type locality.—Mission, British Columbia, Aug. 8, 1904. (R. V. Harvey.)

Related to *A.* (*A.*) *colletina* Cockerell, of which it may prove to be a race.

Female.—Length 9.5 mm.; **body** black, mostly covered with pale ochreous hairs; **head** with its facial line : transfacial line :: 54: 70, axial line : temporal line :: 30: 18, malar line : joint 3 of antennae :: 2: 10, ocelloccipital line : greatest diameter of lateral ocellus :: 4: 5, elevated portion of malar space nearly wanting, head covered with pale ochreous hairs, front rather distinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 8: 13, foveal band present and at upper end of the inner eye margin : ocellocular line :: 1: 13, distance between fovea and ocelli : ocellocular line :: 4: 13, fovea slightly attenuated below its middle where it is apparently only a little narrower than the greatest width of the fovea and continued to a point apparently a little above the clypeal line, fovea filled with pale ochreous hairs, hair of vertex and temples along the upper edge of the eye concolorous with the facial hairs, face mostly polished, partly indistinctly reticulate, with distinct punctures that are mostly adjoining or one or two puncture widths apart, clypeus slightly elevated above the apical margin, convex, sculptured like the face except that the punctures are larger and closer together, clypearea present, well defined, shiny and finely reticulated, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea emarginate on its under surface, its width at base : length down the middle :: 12: 4, width at apex : length down the middle :: 7: 4, its greatest length : width at base :: 5: 12, labrarea at base seemingly a little more than half as wide as the labrum, the latter with a fringe of dark golden hairs, labrum apparently without a definite sculpture or structure between the labrarea and the apical edge of labrum, joint 3 of antennae : 4+5

:: 10: 9, joints 4 and 5 thicker than long, the succeeding joints as thick as long or a little longer than thick, antennae blackish throughout, mandibles typical, robust, extending to the outer edge of the labrarea, black except for the apical half which is dark reddish, palpi nearly typical; **thorax** covered with an abundance of pale ochreous hairs which are as long on the dorsulum where they are darker than the almost whitish hairs on the mesopleura, dorsulum dullish, finely densely reticulated and punctured, the punctures seemingly lost among the dense reticulation, notauli represented by a comparatively smooth dullish line, mesopleura with almost whitish hairs, finely reticulated, somewhat shiny, indistinctly, sparsely punctured, scutel hairy and sculptured much like the dorsulum except that along its anterior edge it is nearly polished, metanotum hairy and densely sculptured, the sculpture nearly hidden by the hairs, tegulae dark brown, reticulated, indistinctly punctured, entirely covered with ochreous hairs, wing base partly blackish brown, subcosta blackish brown, stigma dark stramineous like the costa, rest of veins dull stramineous, with a blackish tinge, first recurrent vein received by the second submarginal cell beyond the middle and a little nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus received by the median cell and forming an acute angle with the second abscissa of the median vein, membrane uniformly tinged with brown, legs blackish except for the small joints of the tarsi which are more or less pale brown; legs covered with brownish golden and ochreous hairs, scopa typical, its hairs pale ochreous, almost white, hairs at base above decidedly darkened, hind metatarsi at most as wide as the mid metatarsi; **propodeum** with its enclosure poorly defined, fullish and finely reticulated, rest of upper face of propodeum indistinctly densely sculptured and covered with fine pale ochreous hair, propodeal pleura shiny, reticulated, with sparse shallow punctures and almost hidden by the almost white floccus; **abdomen** with its tergum shining, finely rectulated and sparsely punctured, the punctures from two to six or more puncture widths apart on the first tergite, the punctures hardly closer on the succeeding tergites, second, third and fourth tergites with an apical, pale ochreous, complete hair band, apical edge of first, second, third and fourth tergites with a stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 17: 10, fifth tergite shining, reticulate, its punctures partly closer together than on the other tergites, pygidium slightly convex, with a shallow furrow on each side, shiny, finely sculptured, nearly pointed at apex, tergum with inconspicuous, pale, nearly erect hairs in addition to the broad hair bands, the nearly erect hairs of the first and second tergites much longer than the analogous hairs of the succeeding tergites, fimbria dull dark brownish.

**Andrena (Andrena) confederata** new species

*Type*.—No. 4072, The Academy of Natural Sciences of Philadelphia. Type locality.—Georgia. (H. K. Morrison.)

Related to *A.* (*A.*) *perplexa* Smith.

Female.—Length 13 mm.; **body** black, mostly covered with pale ochreous or whitish hairs; **head** with its facial line : transfacial line :: 74: 91, axial line : temporal line :: 37 : 19, malar line : joint 3 of antennae :: 2: 17, ocelloccipital

line : greatest diameter of lateral ocellus :: 8: 5, elevated portion of malar space down the middle apparently shorter than the depressed portion, head mostly covered with pale ochreous hairs, front rather indefinitely reticulato-rugulose, not elevated into a welt along the fovea but divided down the middle by a longitudinal carina, fovea at most : ocellocular line :: 15: 17, foveal band virtually wanting at upper end of the inner eye margin, distance between fovea and ocelli: ocellocular line :: 2: 17, fovea somewhat attenuated below its middle where it is apparently only a little more than half as wide as the greatest width of the fovea, the latter continued to a plane apparently a little below the clypeal line, fovea filled with pale ochreous hairs, fovarea wanting, vertex and front with pale ochreous hairs, rest of head with whitish hairs, face mostly shiny, partly dullish, finely reticulate, with shallow punctures that are mostly from adjoining to three puncture widths apart, clypeus distinctly elevated above the apical margin, convex, shiny, finely reticulated, more deeply punctured than the face, the punctures mostly from one to two puncture widths apart, clypearea represented by a slight elevation down the middle and greater interstices between the punctures down the middle, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea submarginate, its width at base: length down the middle :: 17: 5, width at apex : length down the middle :: 8: 5, greatest length of labrarea slightly in excess of the length down the middle, labrarea at base : distance between lower corners of clypeus :: 17: 29, with a fringe of golden hairs, but without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 17: 14, joint 4 a little thicker than long, the succeeding joints from nearly as thick as long to three-fourths as thick as long, except joint 12 which is at least twice as long as thick, antennae blackish except the under side of the flagel which is blackish brown, mandibles typical, robust, extending to the lower corners of the clypeus, black except for most of the apical half which is dark reddish, palpi nearly typical; **thorax** thinly hairy, the hairs on the dorsulum pale ochreous or golden and shorter than the whitish hairs on the mesopleura, dorsulum partly dullish, partly shiny, finely reticulated and punctured much like the clypeus but not so deeply punctured, notauli represented by a dullish line, mesopleura almost rugulosopunctate and finely reticulate, more closely punctured than the dorsulum, scutel nearly polished, metanotum hairy and densely sculptured, indistinctly punctured and dullish, tegulae brownish stramineous, nearly polished, blackish brown at base, wing base partly blackish brown, partly stramineous, subcosta blackish brown, stigma brownish stramineous, rest of veins concolorous with the stigma, first recurrent vein received by the second submarginal cell beyond the middle and nearly as near to the second transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane with a deep brown stain, legs blackish brown except for the small joints of the tarsi which are more or less brownish, legs covered with whitish, golden, and brownish hairs, scopa typical, its hairs of the lower half almost white, of its upper half with a pale golden hue, hairs at base above decidedly darkened, hind metatarsi at most : greatest width of mid metatarsi :: 11: 11; **propodeum** with its enclosure poorly defined, dullish and finely reticulated except its basal

half which is mostly reticulato-rugulose except for its lateral reticulated margins, rest of upper face of propodeum sculptured like the mesopleurae and covered with longer and pale ochreous hair, propodeal pleura finely reticulated, shiny and with sparse shallow punctures from which extend some raised lines in all directions, propodeal floccus pale ochreous; **abdomen** with its tergum shiny, finely reticulated and sparsely punctured, the punctures mostly from two to six puncture widths apart on the first tergite, the punctures sparser and smaller on the succeeding tergites, tergites without conspicuous apical hair band and appearing bare, apical edge of first, second, third, and fourth tergites with a dark brownish stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 26: 12, fifth tergite shiny, reticulate, its punctures larger, less definite and not any closer together than on the other tergites, pygidium nearly planate, rounded at apex, tergum with inconspicuous pale appressed hairs, fimbria brownish golden.

*Allotype.*—No. 4072, The Academy of Natural Sciences of Philadelphia. Georgia. (H. K. Morrison.)

Male.—Length 11 mm.; **body** black, mostly covered with pale ochreous hair; **head** with its facial line : transfacial line :: 61: 79, axial line : temporal line :: 34: 21, temples rounded nearly trapezoidal, malar line : joint 3 of antennae :: 3: 11, elevated portion of malar space down the middle much shorter than the depressed portion, head covered with pale ochreous hairs, front shiny, reticulato-striate, divided by a median longitudinal carina that extends from the anterior ocellus to the supraclypeal area where it ends in a rudimentary spine, ocellocular line : ocelloccipital line :: 17: 6, face dullish, indistinctly punctured, its punctures from one to three puncture widths apart, clypeus nearly planate, clypeus slightly concave, more shining and more distinctly punctured than the face, its punctures from adjoining to two puncture widths apart, not elevated directly above the apical margin, clypearea wanting, sculpture of the clypeus almost hidden by the moustache, labrarea with a slight broad, shallow emargination, polished, its width at base : greatest length :: 14: 5.5, width at apex : length down the middle :: 6: 5, labrarea at base : distance between lower corners of clypeus :: 14: 22, labrum with a fringe of pale golden hairs, joint 3 of antennae : 4 :: 11: 8, joint 4 and following joints from a little more than one and one-half times as long as thick to nearly twice as long as thick, dullish, flagel almost straight in outline, antennae blackish throughout and with stramineous sutures, mandibles nearly typical, rather slender, extending beyond the lower corners of the clypeus and nearly to end of the basal third of its fellow, black except for the apical fourth which is dull dark reddish, palpi nearly typical; **thorax** covered with an abundance of pale dull ochreous hairs, hairs of dorsulum seemingly shorter than hair of mesopleura, dorsulum dullish, finely reticulated and sparsely punctured, the punctures shallow and mostly from two to five puncture widths apart, notauli represented by a shining line, mesopleura dullish with pale ochreous hairs throughout, finely reticulated and mostly covered with shallow adjoining pits, scutel with longer hair than the dorsulum, sculptured somewhat like the dorsulum but

partly almost polished, metanotum hairy and sculptured like the dorsulum except that the sculpture is denser and the hairs are as long as on the scutel, tegulae pale stramineous, shining, delicately reticulated, wing base mostly pale stramineous, subcosta blackish, stigma pale brownish stramineous, first recurrent vein received by the second submarginal cell beyond the middle and a little nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein. Nervulus nearly interstitial, forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly rather deeply tinged with brown, legs dark brown excepting the tarsi which are rather brownish stramineous, hind tarsi pale stramineous, legs covered with pale golden hairs, hind metatarsi at most hardly wider than mid metatarsi and nearly half as wide as hind tibiae at apex of the latter; **propodeum** with its enclosure poorly defined, with irregular rugae on basal half, finely reticulated on apical half, rounded off at apex, rest of upper face sculptured much like the mesopleura and covered with pale ochreous hair, propodeal pleura sculptured much like the mesopleura, the sculpture better defined, propodeal scopa pale, **abdomen** with its tergum shining, almost polished, finely reticulated and indistinctly punctured, the punctures mostly three or four puncture widths apart, first and second tergites with erect pale ochreous hairs, second and third tergites with pale ochreous appressed hairs, second tergite with its elevated portion down the middle: depressed portion :: 22: 11, third and fourth tergites with pale ochreous appressed hairs on the elevated portion, fifth tergite with its basal blackish portion covered with poorly defined punctures that are as many as six or more puncture widths apart, rest of fifth tergite and apical margin of sixth tergite with a stramineous margin, anal process broad, almost parallel-sided and slightly emarginate at apex, tergum with rather inconspicuous hairs and without apical hair bands, hair at apex of abdomen of a golden hue.

Other locality.—Potomac Run, Virginia, May 30, 1916, at flowers of *Apocynum medium*. (W. L. McAtee.)

**Andrena (Andrena) elongatula** new species

*Type*.—No. 4056, The Academy of Natural Sciences of Philadelphia. Type locality.—Southern California. (H. K. Morrison.)

Has characters in common with *A.* (*A.*) *subaustralis* Cockerell.

Male.—Length 12 mm.; **body** black, mostly covered with whitish hair; **head** with its facial line : transfacial line :: 48: 83, axial line : temporal line :: 38: 24, temples produced, trapezoidal, the angle apparently opposite middle of eye, malar line : joint 3 of antennae :: 1: 9, elevated portion of malar space virtually wanting, head covered with whitish hairs except along the inner eye margin, upper eye margin, and outer eye margin above middle of temples and on upper half of front where the hairs are black or blackish or dark brown, front indistinctly punctured, dullish, finely longitudinally striate except for the narrow fovea along the upper half of the inner eye margin, ocellocular line : ocelloccipital line :: 19: 7, face shiny, distinctly punctured, its punctures from adjoining to three or four puncture widths apart, clypeus slightly convex

nearly planate, not so shiny or so distinctly punctured as the face, not especially elevated directly above the apical margin, clypearea wanting, sculpture of the clypeus virtually hidden by the moustache, dullish, finely reticulated and with adjoining punctures, labrarea broadly truncate, polished, its width at base : greatest length :: 13: 5, width at apex : length down the middle :: 8: 5, labrarea impressed and at base nearly as wide as the labrum, the latter with a fringe of golden hairs, joint 3 of antennae : 4: : 9: 8, joint 4 with its length : thickness :: 6: 7, joints 5–7 approximately one and one-half times as long as thick, dullish, flagel almost straight in outline, antennae presumably blackish throughout, mandibles nearly typical, rather slender, apparently extending a little beyond the outer edge of the labrum, black except for the apex and inner margin which are dull dark reddish, palpi nearly typical; **thorax** covered with an abundance of whitish hairs, hairs of dorsulum seemingly a little shorter than hair of mesopleura and with an ochreous tinge, dorsulum dullish, finely reticulated and not appreciably punctured, notauli represented by a dullish line, mesopleura dullish with whitish hairs throughout, finely reticulated and with ill-defined punctures that are mostly three or more puncture widths apart, scutel hairy and sculptured like the dorsulum, metanotum hairy and sculptured apparently like the dorsulum, tegulae dark brown, polished, wing base mostly blackish and dark brown, subcosta blackish, stigma yellowing stramineous with a blackish tinge, first recurrent vein received by the second submarginal cell a little before the middle and a little farther from the first transverse cubitus than the first transverse cubitus is from the stigma on the radial vein, nervulus almost exactly interstitial, forming an acute angle with the first abscissa of the discoidal vein, veins dull brownish stramineous, membrane uniformly tinged with brown, legs blackish excepting the tarsi and hind tibiae which are rather blackish brown, legs covered with whitish and golden hairs, hind metatarsi at most hardly wider than mid metatarsi and nearly half as wide as hind tibiae at apex of the latter; **propodeum** with its enclosure rather well defined, with irregular rugae on basal half, finely reticulated on apical half, rounded off at apex, rest of upper face sculptured somewhat like the mesopleura, propodeal pleura sculptured, partly, apparently like the mesopleura, the sculpture nearly hidden by the uniformly distributed whitish hairs; **abdomen** with its tergum shiny, blackish brown, almost polished, finely reticulated and indistinctly punctured, the punctures mostly three or four puncture widths apart, first tergite with erect whitish hairs, second tergite with appressed whitish hairs, second tergite with its elevated portion down the middle : depressed portion :: 20: 6, third and following tergites with brownish appressed hairs on the elevated portion, tergites with a pale brownish stramineous margin, anal process narrow, almost parallel sided and irregularly truncate at apex, tergum with rather inconspicuous hairs that are supplemented on the sides of the third and following tergites by thin golden apical hair bands, hair at apex of abdomen seal brown.

**Andrena (Andrena) fuscisignata** new species

*Type*.—No. 4071, The Academy of Natural Sciences of Philadelphia. Type locality.—Orono, Maine (No. 32).

Related to *A.* (*A.*) *trizonata* (Ashmead.)

Female.—Length 8.5 mm.; **body** black, mostly covered with whitish hairs, **head** with its facial line : transfacial line :: 49: 58, axial line : temporal line :: 23: 13, malar line : joint 3 of antennae :: 2.5: 7.5, ocelloccipital line : greatest diameter of lateral ocellus :: 3: 4, elevated portion of malar space nearly as long as depressed portion, head covered with whitish hairs, front rather distinctly, longitudinally striate, not elevated into a welt along the fovea, width of fovea at most : ocellocular line :: 6: 12, foveal band present and at upper end of the inner eye margin : ocellocular line :: 1: 12, distance between fovea and ocelli: ocellocular line :: 4.5: 12, fovea attenuated below its middle where it is a little narrower than the greatest width of the fovea, the latter continued to a plane apparently a little below the antennal line, upper half of fovea mostly filled with pale brownish hairs, lower half with whitish hairs, fovarea wanting, face shiny, finely reticulate, with rather poorly defined punctures that are from adjoining to three punctures widths apart, clypeus distinctly elevated above the apical margin, convex, more distinctly reticulated than the face, with its punctures wider apart and larger than on the face, apical half more shiny than the face and with its anterior margin nearly polished, clypearea wanting, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea truncate, its width at base : length down the middle :: 11: 4, width at apex: length down the middle : 3.5 : 4, labrarea at base : distance between lower corners of clypeus :: 11: 16, labrum with a fringe of golden hairs and without a median longitudinal crista between the labrarea and its apical edge, joint 3 of antennae : 4+5 :: 7.5: 7, joints 4 and 5 thicker than long, the succeeding joints from as long as thick to a little longer than thick except joint 12 which is distinctly longer than thick, antennae blackish throughout except the under side of the flagel which is dark brown, mandibles typical, robust, extending to the outer corners of the clypeus, black except for the apical half which is mostly dark reddish, palpi nearly typical; **thorax** covered with an abundance of whitish hairs which are nearly as long on the dorsulum as the whitish hairs on the mesopleura, dorsulum dullish, finely reticulated and punctured like the face but more distinctly so, notauli represented by a shiny line, mesopleura finely reticulated, more sparsely and less distinctly punctured than the dorsulum, scutel hairy and sculptured much like the dorsulum, metanotum hairy and densely sculptured, tegulae brownish stramineous, partly polished, wing base partly blackish brown, subcosta blackish brown, stigma reddish, rest of veins dull stramineous, first recurrent vein received by the second submarginal cell before the middle and not as near to the first transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane with a uniform yellowish brown tinge, legs blackish brown except for the tarsi which are more or less dark brown, legs covered with whitish and golden hairs, scopa nearly typical, more ample, its hairs whitish, except at base and apex where they are brownish, width of hind metatarsi at most : greatest width of mid metatarsi :: 7: 6; **propodeum** with its enclosure poorly defined, its basal half mostly rugulose, its apical half mostly dullish and finely reticulated, rest of

upper face of propodeum sculptured somewhat like the mesopleura but with more distinct punctures, and covered with finer hair, propodeal pleura with sparse shallow punctures and finely reticulated, propodeal floccus whitish; **abdomen** with its tergum shining and sculptured much like the metapleura except that the reticulation is finer and the punctures more distinct, the punctures mostly from four to six puncture widths apart on the first tergite, the punctures hardly closer on the succeeding tergites, second, third and fourth tergites with a thin apical, whitish hair band, apical edge of first, second, third and fourth tergites with a stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 13: 9, fifth tergite shiny, reticulate, its punctures more apparent than on the other tergites, pygidium nearly pointed at apex, planate, with a median, nearly triangular embossed area, tergum with inconspicuous, pale, nearly erect hairs, in addition to the hair bands, fimbria pale brownish stramineous.

*Allotype.*—No. 4071, The Academy of Natural Sciences of Philadelphia. New Hampshire. (C. F. Baker No. 1869.)

Male.—Length 8 mm.; **body** black, mostly covered with whitish hair; **head** with its facial line : transfacial line :: 42 : 52, axial line : temporal line :: 22: 12, temples rounded, nearly trapezoidal, malar line : joint 3 of antennae :: 2: 6.5, elevated portion of malar space down its middle shorter than the depressed portion, head covered with whitish hairs except along the inner, outer and upper eye margin, and on most of the clypeus where the hairs are black, front distinctly striato-rugulose, shiny, ocellocular line : ocelloccipital line :: 12: 3, face shiny, distinctly punctured, its punctures from one to three puncture widths apart and partly nearly hidden by the hairs, clypeus nearly convex, barely elevated above the apical margin, more shiny and more distinctly punctured than the face, clypearea wanting, sculpture of the clypeus not hidden by the moustache, labrarea with a shallow rounded emargination, polished, its width at base : greatest length :: 7: 4, width at apex : length down the middle :: 3.5: 3, labrarea at base : distance between lower corners of the clypeus :: 7: 12, labrum with a fringe of golden hairs, joint 3 of antennae : 4 :: 6.5 : 5, joint 4 and following joints from a little longer than thick to twice as long as thick, shiny, flagel undulate in outline, antennae blackish throughout, mandibles atypical, rather robust, extending a little beyond the outer corners of the clypeus and nearly to the end of the basal third of their fellow, black except for the apical third which is mostly dark reddish, palpi nearly typical; **thorax** covered with an abundance of dull pale ochreous or whitish hairs, hairs of dorsulum scemingly shorter than hairs of mesopleura, dorsulum dullish, finely reticulated and sparsely indistinctly punctured, the punctures mostly from one to three puncture widths apart, notauli represented by a shiny line, mesopleura dullish, with whitish and a few blackish hairs throughout, finely reticulated and covered with shallow pits that are mostly two or more pit widths apart, scutel hairy and sculptured like the dorsulum, metanotum hairy and sculptured like the dorsulum, except that the sculpture is denser, tegulae pale stramineous with blackish stains, polished, wing base brownish and pale stramineous,

subcosta dark brown, stigma pale brownish stramineous, first recurrent vein received by the second submarginal cell a little beyond the middle but not as near to the second transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial, forming an acute angle with the first abscissa of the discoidal vein, membrane with a uniform yellowish brown tinge, legs blackish brown excepting the small joints of the tarsi which are brownish, legs covered with whitish hairs, hind metatarsi at most hardly wider than middle metatarsi and nearly half as wide as hind tibiae at apex of the latter; **propodeum** with its enclosure poorly defined, with irregular rugae on basal half, finely reticulated on apical half, rounded off at apex, rest of upper face sculptured somewhat like the metanotum and covered with whitish hair, propodeal pleura sculptured apparently like the mesopleura, the sculpture not at all hidden by the uniformly distributed whitish hairs; **abdomen** with its tergum shiny, finely reticulated and indistinctly punctured, the punctures mostly four or more puncture widths apart, first tergite with whitish erect hairs, second and following tergites with appressed whitish hairs, second tergite with its elevated portion down the middle : depressed portion :: 12: 6, fifth tergite with its basal blackish portion covered with poorly defined punctures that are as many as six or more puncture widths apart, fifth, sixth and seventh tergites with a stramineous margin, anal process narrow, pale stramineous, rounded at apex, tergum with rather inconspicuous hairs that are supplemented on the sides of the second, third and fourth tergites by thin whitish apical hair bands, hair at apex of abdomen of a pale golden hue.

**Andrena (Andrena) mariposorum** new species

*Type.*—No. 4050, The Academy of Natural Sciences of Philadelphia. Type locality.—Southern California. (H. K. Morrison.)

Related to *A.* (*A.*) *salicinella* Cockerell, of which it may prove to be a race. Professor Cockerell, who compared the type with a topotypic specimen of *A.* (*A.*) *salicinella* Cockerell, says that in *A.* (*A.*) *mariposorum* the wings are longer, sculpture of clypeus not the same, etc. He avers that it is possibly a subspecies only.

Female.—Length 8.5 mm.; **body** black, mostly covered with whitish hairs, **head** with its facial line : transfacial line :: 47: 59, axial line : temporal line :: 22: 14, malar line : joint 3 of antennae :: 1: 7, ocelloccipital line : greatest diameter of lateral ocellus :: 3: 4.5, elevated portion of malar space virtually wanting, head covered with whitish hairs, front distinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 6: 11, foveal band represented at upper end of the inner eye margin by a bevelled, bare space, distance between fovea and ocelli : ocellocular line :: 5: 11, fovea somewhat attenuated below its middle, and continued to a plane apparently half way between the clypeal and antennal line, fovea filled with pale ochreous or golden hairs, fovarea wanting, vertex and temples along the

upper edge of the eye with whitish hairs, face brownish, shiny, finely reticulate, with indistinctly defined punctures that are mostly from two to four puncture widths apart, clypeus virtually not at all elevated above the apical margin, nearly planate, brownish and blackish, sculptured like the face except that the punctures are larger and well defined, clypearea present but poorly defined and finely reticulated, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea with its anterior margin convex, its width at base : length down the middle :: 10: 3, labrarea at base : distance between lower corners of clypeus :: 10: 17, labrum with a fringe of golden hairs and without a median longitudinal crista between its apical edge and the labrarea, joint 3 of antennae : 4+5 :: 7: 6, joints 4 to 9 inclusive thicker than long, the succeeding joints a little longer than thick except joint 12 which is distinctly longer than thick, antennae brownish except for the blackish scape, mandibles typical, robust, not overlapping, reddish except for the basal fourth which is blackish, palpi nearly typical; **thorax** thinly covered with whitish hairs which are shorter on the dorsulum than the whitish hairs on the mesopleura, dorsulum dullish, finely reticulated and punctured like the face but more distinctly and densely so, notauli represented by a shallow impression, mesopleura sculptured somewhat like the face but more shiny and not so distinctly punctured, scutel hairy and sculptured much like the dorsulum except that the sculpture is not so dense and the surface more shiny, partly almost polished, metanotum hairy and sculptured much like the dorsulum except that the sculpture is denser and indistinct, tegulae brownish stramineous, nearly polished, wing base dull stramineous, subcosta dark brownish stramineous, stigma pale yellowish stramineous, with its lower margin brownish, rest of veins dull stramineous, mostly somewhat paler than the stigma, without a blackish tinge, first recurrent vein received by the second submarginal cell beyond the middle and nearly as near to the second transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly with a dark tinge, nearly colorless, legs dark brown except for the tarsi and hind tibiae which are more or less pale brownish stramineous, legs covered with whitish and pale golden hairs, scopa nearly typical, its hairs whitish throughout, hind metatarsi at most apparently as wide as the middle metatarsi; **propodeum** with its enclosure poorly defined, dullish and finely reticulated except for a nearly radiate network of fine carinae along the basal margin, rest of upper face of propodeum sculptured somewhat like the metanotum and covered with fine whitish hair, propodeal pleura very shiny, delicately reticulated and with a few, very small scattered, shallow punctures and more or less hidden by the whitish floccus; **abdomen** with its tergum shiny, finely reticulated and indistinctly punctured, the punctures from two to four or more puncture widths apart on the first tergite, the punctures not so close on the succeeding tergites, second, third, and fourth tergites with an apical, whitish hair band that is interrupted in the middle of the second, apical edge of first, second, third, and fourth tergites with a stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 11: 8, fifth tergite shiny, reticulate, its punctures more evident than

on the other tergites, pygidium nearly planate, without a shallow furrow on each side, nearly truncate at apex, tergum with inconspicuous, pale appressed hairs in addition to the hair bands, fimbria pale ochreous or pale golden.

**Andrena (Andrena) mellitarsis** new species

*Type.*—No. 4057, The Academy of Natural Sciences of Philadelphia. Type locality.—Nevada. (H. K. Morrison.)

Related to *A.* (*A.*) *thaspii* Graenicher.

Male.—Length 8.5 mm.; **body** black, mostly covered with whitish hair; **head** with its facial line : transfacial line :: 44: 56, axial line : temporal line :: 23: 13, temples rounded, subtrapezoidal, malar line : joint 3 of antennae :: 2: 7, elevated portion of malar space much shorter than the depressed portion, head covered with whitish hairs except along the inner eye margin, upper eye margin, and outer eye margin above the middle of temples and on upper half of front where the hairs are black, front rather coarsely, indefinitely reticulated and sculptured, partly longitudinally striate, fovea narrow, ocellocular line : occelloccipital line :: 11: 4, face shiny, distinctly punctured, its punctures from one to three puncture widths apart, clypeus slightly convex, clypeus apparently slightly elevated above apex more shiny and more distinctly coarsely and closely punctured than the face, clypearea wanting, sculpture of the clypeus not hidden by the moustache, labrarea with a narrow rounded shallow emargination, polished, its width at base : greatest length :: 5: 4, width at apex: length down the middle :: 3.5 : 3, labrarea at base apparently one-third as wide as the labrum, the latter with a fringe of pale golden hairs, joint 3 of antennae : 4 :: 7: 6, joint 4 as long as thick, the following joints from a little longer than thick to nearly one and one-half times as long as thick, dullish, flagel somewhat undulate in outline, antennae blackish throughout, mandibles atypical, rather slender, extending beyond the outer edge of the labrum and to the end of the basal half of their fellow, black except for the apical third which is dark reddish, palpi nearly typical; **thorax** covered with an abundance of whitish hairs, hairs of dorsulum seemingly shorter than hair of mesopleura, dorsulum dullish, finely reticulated and sparsely punctured, the punctures shallow and from one to five puncture widths apart, mostly two or three puncture widths apart, notauli represented by a shiny line, mesopleura dullish with whitish hairs throughout, finely reticulated and sparsely punctured like the mesonotum but not so obviously, scutel hairy and sculptured much like the dorsulum, metanotum hairy and densely sculptured, not so definitely sculptured as the dorsulum, tegulae dark brown, polished, wing base mostly pale stramineous, partly brownish, subcosta dark brown, rest of veins pale brownish stramineous, stigma stramineous with blackish or dark hairs, first recurrent vein received by the second submarginal cell beyond the middle and a little nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus received by the median vein, forming an acute angle with the second abscissa of the median vein, membrane with uniformly pale brownish stramineous tinge, legs blackish brown excepting the hind metatarsi which are pale yellowish stramineous, legs covered with whitish hairs, hind metatarsi at most hardly wider than mid metatarsi and nearly half as wide as hind tibiae

at apex of the latter; **propodeum** with its enclosure poorly defined, with irregular, fine rugae along the basal edge, elsewhere finely reticulated, rounded off at apex, rest of upper face sculptured somewhat like the mesopleura and covered with whitish hair, propodeal pleura sculptured like the mesopleura, the sculpture not hidden by the whitish hairs; **abdomen** with its tergum shiny almost polished, finely reticulated and indistinctly punctured, the punctures mostly three or four puncture widths apart, first tergite, with erect whitish hairs, second and third tergites with dark, appressed hairs, second tergite with its elevated portion down the middle : depressed portion :: 15: 5, third, fourth and fifth tergites with brownish appressed hairs on the elevated portion, fifth tergite with its basal blackish portion covered with poorly defined punctures that are as many as four puncture widths apart, rest of fifth tergite and exposed portion of sixth and seventh tergites with a stramineous margin, anal process expanding toward apex and deeply emarginate at apex, tergum with rather inconspicuous hairs that are supplemented on the second, third, fourth and fifth tergites by white, apical hair bands that are more or less interrupted in the middle, hair at apex of abdomen of a golden hue.

**Andrena (Andrena) nasoni fulvodorsata** new variety

*Type*.—No. 4059, The Academy of Natural Sciences of Philadelphia. Type locality.—Fedor, Lee Co., Texas, March 22, 1905. (G. Birkmann.)

Female.—Differs from typical *A.* (*A.*) *nasoni* Robertson in the hair of the dorsum of the thorax being fulvous.

**Andrena (Andrena) omninigra**[5] new species

*Type*.—No. 4046, The Academy of Natural Sciences of Philadelphia. Type locality.—California. (E. Norton.)

Related to *A.* (*A.*) *stictigastra* Viereck.

Female.—Length 15 mm.; **body** black, covered throughout with black or blackish brown hairs; **head** with its facial line : transfacial line :: 79: 93, axial line : temporal line :: 40: 25, malar line : joint 3 of antennae :: 2: 11, occlocciptal line : greatest diameter of lateral ocellus :: 7: 6.5, elevated portion of malar space represented by a shiny line, front distinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 14: 18, foveal band represented by a shiny line, distance between fovea and ocelli : ocellocular line :: 4: 18, fovea attenuated below its middle where it is apparently nearly as wide as the greatest width of the fovea, the latter continued to a point apparently on the clypeal line, fovea filled with blackish brown hairs, face mostly polished, not reticulate, with distinct punctures that are as many as three puncture widths apart near the eye margin, where the punctures are larger than near the clypeus where they are adjoining or nearly adjoining, clypeus distinctly elevated above the apical margin, slightly convex, its punctures larger than the largest of the face, well defined and from adjoining to two

[5] This specific name was proposed for this species by Prof. W. M. Davis.

puncture widths apart, clypearea very narrow but conspicuous, clypeus thinly hairy its sculpture not at all hidden by hairs, labrarea funnel shaped in outline, rounded at apex, its width at base : length down the middle :: 13: 9, width at apex : length down the middle :: 2: 9, labrarea at base a little more than half as wide as the labrum, the latter with a fringe of brownish hairs, labrum with a poorly developed median longitudinal crista between the labrarea and apical edge of labrum and closely punctured, joint 3 of antennae : 4+5 :: 12: 12, joints 4 and 5 thicker than long, the succeeding joints as thick as long except joint 12 which is distinctly longer than thick, antennae blackish brown throughout, mandibles typical, robust, extending near to the outer edge of the labrarea, black except for the apical fourth which is dark reddish, palpi nearly typical; **thorax** with short, stiff, dense and inconspicuous hairs on the dorsulum, mesopleura with long rather sparse hairs, dorsulum dullish, finely, indistinctly reticulated and with distinct, adjoining or nearly adjoining punctures, notauli represented by a shiny line, mesopleura sculptured somewhat like the dorsulum but not so closely punctured, scutel hairy and sculptured much like the dorsulum, metanotum hairy and sculptured like the dorsulum except that the sculpture is denser and less distinct, tegulae dark brown, polished, indistinctly reticulated in part, wing base partly blackish brown, subcosta and stigma blackish brown, rest of veins nearly as dark as the stigma, first recurrent vein received by the second submarginal cell beyond the middle, a little farther from the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus nearly exactly interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly deep brown, legs blackish except for the tarsi which are more or less dark brown, legs covered with brownish and black hairs, scopa atypical, its hairs black throughout, nearly erect and mostly apparently longer than the greatest width of hind tibiae; **propodeum** with its enclosure well defined, shiny, indistinctly rugulose and with irregular coarse rugae on each side of a median longitudinal carina, rest of upper face of propodeum coarsely reticulated, and covered with fine long hair, propodeal pleura finely reticulated, with sparse shallow pits and not almost hidden by the floccus; **abdomen** with its tergum shiny and sculptured much like the clypeus but with smaller more sharply defined punctures, the punctures from nearly adjoining to three puncture widths apart on the first tergite, the punctures not closer on the succeeding tergites, second, third and fourth tergites without an apical hair band, apical edge of first, second, third and fourth tergites concolorous with the rest of the blackish brown tergite, second tergite with its elevated portion down the middle : depressed portion :: 24: 13, fifth tergite shiny, reticulate, its punctures not so clearly defined as on the other tergites, pygidium nearly planate, with a shallow furrow on each side, nearly pointed at apex, tergum with inconspicuous appressed black hairs, fimbria black.

**Andrena (Andrena) perezana thaspiiformis** new race

*Type.*—No. 4052, The Academy of Natural Sciences of Philadelphia. Type locality.—Southern California. (H. K. Morrison.)

Female.—Differs from typical *A.* (*A.*) *perezana* Viereck and Cockerell chiefly as follows:—Pubescence ochreous to fulvous, foveal hairs bicolored, longest hairs of the labrum nearly as long as the labrum down the middle, clypearea virtually wanting, clypeus more coarsely, not so closely punctured, dorsulum not at all polished, hind tibiae mostly stramineous, partly dark, fimbria fulvous.

**Andrena (Andrena) tincta**[6] new species

*Type.*—No. 4066, The Academy of Natural Sciences of Philadelphia. Type locality.—Georgetown, Colorado. July 8. (Packard.)

Related to *A.* (*A.*) *subtilis* Smith.

Female.—Length 10 mm.; **body** black, mostly covered with pale ochreous hairs; **head** with its facial line : transfacial line :: 59: 71, axial line : temporal line :: 30: 19, malar line : joint 3 of antennae :: 3: 10, ocelloccipital line : greatest diameter of lateral ocellus :: 3: 5, elevated portion of malar space nearly as long as the depressed portion, head partly covered with whitish hairs, front rather distinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 11: 14, foveal band virtually wanting at upper end of the inner eye margin, distance between fovea and ocelli : ocellocular line :: 2: 14, fovea attenuated below its middle and continued to a plane apparently a little above the clypeal line, fovea filled with brownish golden hairs, fovarea wanting, vertex and temples along the upper edge of the eye with dark brown or blackish hairs, face partly polished, mostly finely reticulate, with distinct punctures that are as many as four puncture widths apart, clypeus distinctly elevated above the apical margin, convex, mostly polished, otherwise sculptured like the face except that the punctures are larger and better defined and from one to ten puncture widths apart, clypearea present but poorly defined, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea truncate, its width at base : length down the middle :: 10: 4, width at apex: length down the middle :: 8: 4, labrarea at base : distance between the lower angles of the clypeus :: 10: 20, labrum with a fringe of golden hairs, labrum apparently without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 10: 10, joint 4 a little thicker than long, the succeeding joints from as thick as long to a little longer than thick except joint 12 which is distinctly longer than thick, antennae dark brownish throughout, mandibles typical, robust, extending to the outer edge of the labrarea, black except for the apical third which is mostly dark reddish, palpi nearly typical; **thorax** covered with an abundance of pale ochreous hairs which are shorter on the dorsulum than on the mesopleura, dorsulum dullish, finely, densely reticulated and indistinctly punctured, notauli represented by a shiny line, mesopleura sculptured somewhat like the dorsulum but not so dull, scutel shiny, hairy and sculptured much like the dorsulum but not so densely, metanotum sculptured like the dorsulum but with longer hairs, tegulae dark brownish stramineous, polished, wing base brownish stramineous, subcosta blackish

[6] This name was proposed for this species by Prof. W. M. Davis.

brown, stigma yellowish brown, rest of veins dull stramineous, first recurrent vein received by the second submarginal cell beyond the middle and distinctly nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus not interstitial and forming an acute angle with the second abscissa of the median vein, membrane with a uniformly yellowish-brown tinge, legs blackish brown except for the tarsi which are more or less pale brown, femora partly covered with ochreous hairs, rest of legs except coxae and trochanters covered with brownish golden hairs, scopa atypical, its hairs shorter than the greatest width of hind tibiae, compactly arranged and uniformly dark brown, hind metatarsi at most as wide as mid metatarsi or :: 12: 12; **propodeum** with its enclosure poorly defined, dullish and finely reticulated, rest of upper face of propodeum sculptured like the mesopleura but with smaller punctures, and covered with finer pale ochreous hair, propodeal pleura with sparse shallow punctures, propodeal floccus pale ochreous; **abdomen** with its tergum shiny, finely reticulated and finely punctured, the punctures mostly from two to six puncture widths apart on the first tergite, the punctures hardly closer on the succeeding tergites, conspicuous hair bands wanting, apical edge of first, second, third, and fourth tergites with a stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 15: 12, fifth tergite shiny, reticulate, its punctures coarser and closer together than on the other tergites, pygidium convex, without a shallow furrow on each side, truncate at apex, tergum with inconspicuous, pale nearly erect hairs on the first and second segments and mostly blackish nearly appressed hairs on the succeeding tergites, fimbria dark seal brown.

Other locality.—Longview, Colorado. June 24, 1916. (E. C. Jackson.)

**Andrena (Andrena) trivialis** new species

*Type*.—No. 4055, The Academy of Natural Sciences of Philadelphia. Type locality.—Southern California. (H. K. Morrison.)

Related to *A.* (*A.*) *illinoensis* Robertson.

Female.—Length 8.5 mm.; **body** black, with the head and abdomen barely tinged with green, mostly covered with whitish hairs, **head** with its facial line : transfacial line :: 45: 64, axial line : temporal line :: 27: 15, malar line : joint 3 of antennae :: 2: 8, ocelloccipital line : greatest diameter of lateral ocellus :: 4: 4, elevated portion of malar space nearly as long as depressed portion, head covered with whitish hairs, front rather distinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 7: 14, foveal band present and at upper end of the inner eye margin: ocellocular line : 1.5 : 14, distance between fovea and ocelli : ocellocular line :: 7: 14, fovea attenuated below its middle where it is apparently only one-half or a little more than half as wide as the greatest width of the fovea, the latter continued to a point apparently on the antennal line, fovea filled with dark seal brown hairs except along the lower edge where the hairs are pale, vertex and temples along

the upper edge of the eye with some dark hairs, face mostly dullish, finely, distinctly reticulate, with rather ill-defined punctures that are as many as three puncture widths apart, clypeus distinctly elevated above the apical margin, slightly convex, sculptured like the face except that the punctures are better defined and not so close together, clypearea present but poorly defined, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea submarginate, its width at base : length down the middle :: 9: 2.5, width at apex : length down the middle :: 5.5: 2.5, greatest length : width at base :: 3: 9, labrarea at base apparently a little more than half as wide as the labrum, the latter with a fringe of golden hairs, labrum without definite sculpture or structure between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 8: 7, joints 4 and 5 thicker than long, the succeeding joints as thick as long or a little longer than thick except joint 12 which is distinctly longer than thick, antennae blackish throughout, mandibles typical, robust, extending nearly to the outer edge of the labrarea, black except for the apical third which is mostly dark reddish, palpi nearly typical; **thorax** thinly covered with whitish hairs which are as long on the dorsulum as the almost white hairs on the mesopleura, dorsulum dullish, finely reticulated, indistinctly punctured, the punctures sparser than on the clypeus, notauli represented by a shiny line, mesopleura sculptured somewhat like the dorsulum but more closely punctured, the punctures crater-like, scutel hairy and sculptured much like the dorsulum, metanotum hairy and sculptured like the dorsulum except that the sculpture is denser and less distinct, tegulae dark brown, polished, wing base partly blackish brown, subcosta blackish brown, stigma pale brownish stramineous, rest of veins dull stramineous, with a blackish tinge, first recurrent vein received by the second submarginal cell in or a little beyond the middle and nearly as near to the second transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly tinged with brown, legs blackish except for the tarsi which are more or less light brown, legs covered with whitish and golden brown hairs, scopa atypical, its hairs whitish and brownish, at most apparently shorter than the greatest width of hind tibiae, mostly nearly erect not hiding the tegument, hairs at base above decidedly darkened, hind metatarsi at most apparently a little wider than middle metatarsi, more than half as wide as hind tibiae at apex; **propodeum** with its enclosure poorly defined, dullish and finely reticulated, rest of upper face of propodeum sculptured somewhat like the enclosure, apparently more finely, and covered with whitish hair, propodeal pleura with a few sparse, shallow, crater-like punctures, finely reticulated, shiny, and almost hidden by the almost white floccus; **abdomen** with its tergum shiny, finely reticulated and almost impunctate, the indistinct punctures from two to six or more puncture widths apart on the first tergite, the punctures apparently sparser on the succeeding tergites, second, third and fourth tergites with an apical, whitish hair band that is interrupted in the middle, apical edge of first, second, third and fourth tergites with a stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 15: 6, fifth tergite shiny, reticulate, its punctures distinct and

apparently closer together than on the other tergites, pygidium slightly convex, apparently without a shallow furrow on each side, nearly pointed at apex, black, tergum with inconspicuous pale nearly erect hairs in addition to the hair bands, fimbria dull pale brownish or whitish with a brownish tinge.

**Andrena (Gonandrena) persimulata**[7] new subgenus, new species

*Type*.—No. 4069, The Academy of Natural Sciences of Philadelphia. Type locality.—Milwaukee, Wisconsin. June 5, No. 15. (S. Graenicher.)

Ignoring the mesopleura, this species is related to *A.* (*P.*) *pallidifovea* Viereck. Superficially it is like *A.* (*A.*) *barbarica* Viereck.

Female.—Length 9 mm.; **body** black, mostly covered with pale ochreous or whitish hairs; **head** with its facial line : transfacial line :: 50: 61, axial line: temporal line :: 26: 16, malar line : joint 3 of antennae :: 1.5: 8, ocelloccipital line : greatest diameter of lateral ocellus :: 4: 4, elevated portion of malar space virtually wanting, head covered with whitish hairs, front rather indistinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 5: 10, foveal band present and near upper end of the inner eye margin : ocellocular line :: 1.5: 10, distance between fovea and ocelli : ocellocular line :: 4.5: 10, fovea slightly attenuated below its middle and continued to a place apparently on the clypeal line, fovea filled with pale ochreous hairs, fovarea wanting, face partly polished, mostly indistinctly reticulate, with distinct punctures that are as many as five or more puncture widths apart, through mostly one to three puncture widths apart, clypeus not elevated above the apical margin, which latter is somewhat turned up, clypeus convex, finely reticulated and distinctly punctured, the punctures mostly from two to four puncture widths apart, clypearea wanting, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea nearly quadrate, but rounded off at apex, its width at base : length down the middle :: 7: 5, width at apex : length down the middle :: 5: 5, distance between lower angles of clypeus : width of labrum at base :: 16: 7, labrum with a fringe of golden hairs and without a median longitudinal crista between the labrarea and the apical edge of the labrum, joint 3 of antennae : 4+5 :: 8: 7, joints 4 and 5 much thicker than long, the succeeding joints from a little thicker than long to a little longer than thick except joint 12 which is nearly twice as long as thick, antennae blackish above, blackish brown beneath, mandibles typical, robust, extending almost to the lower corners of the clypeus, black except for the apical half which is mostly dark reddish, palpi nearly typical; **thorax** covered with an abundance of pale hairs which are shorter on the dorsulum where they are ochreous than the whitish hairs on the mesopleura, dorsulum dullish, reticulated and punctured like the clypeus but more distinctly so, notauli represented by a shiny line, mesopleura almost conically produced at the anterior inferior corner, finely reticulate and indistinctly punctured, scutel hairy and punctured much like

[7] This species was doubtfully referred to *A. simulata* Provancher by Dr. Graenicher.

the dorsulum, indistinctly reticulate, nearly polished and with coarser, longer hairs, metanotum hairy like the scutel and densely sculptured, tegulae brownish stramineous, partly polished, wing base partly blackish brown, subcosta brownish stramineous, stigma yellowish stramineous, rest of veins concolorous with the stigma, first recurrent vein received by the second submarginal cell far beyond the middle and almost interstitial with the second transverse cubitus, nervulus not interstitial but received by the median cell and forming an acute angle with the second abscissa of the median vein, membrane with a uniformly yellowish tinge, legs blackish except for the femora and fore and middle tibiae, which are very dark brown, and the tarsi and hind tibiae, which are more or less paler brown than the femora, legs covered with brownish golden and ochreous hairs, scopa nearly typical except for having most of its hairs branched, its hairs pale ochreous except at base above where they are darkened, hind metatarsi at most apparently as wide as the mid metatarsi; **propodeum** with its enclosure rather poorly defined, shiny and coarsely wrinkled, rest of upper face of propodeum wrinkled but much more finely than the enclosure, and covered with fine pale ochreous hair, propodeal pleura finely reticulated and loosely wrinkled, with sparse indistinct shallow punctures, propodeal floccus thin and pale ochreous; **abdomen** with its tergum shiny and nearly polished, the punctures mostly from four to six puncture widths apart on the first tergite, the punctures apparently twice or more than twice as close together on the succeeding tergites, second, third and fourth tergites with an apical, whitish hair band that is interrupted in the middle of the second and third, apical edge of first, second, third, and fourth tergites with a brownish border, second tergite with its elevated portion down the middle : depressed portion :: 14: 9, fifth tergite shiny, reticulate, its punctures coarser than on the other tergites and apparently as sparse as on the first tergite, pygidium narrowly truncate at apex with a broad shallow furrow on each side of an acute-angled, embossed, sculptured area, tergum with inconspicuous pale appressed hairs, in addition to the hair bands, fimbria dark golden.

Other locality.—Montreal Isl., Quebec. May 21, 1904. (Baker No. 4769.) In this specimen the labrarea is larger than in the type.

**Andrena** (**Parandrena**) **parachalybea** new species

*Type*.—No. 4054, The Academy of Natural Sciences of Philadelphia. Type locality.—Southern California. (H. K. Morrison.)

Related to *A.* (*P.*) *olivacea* Viereck.

Female.—Length 10 mm.; **body** bluish, mostly covered with whitish hairs; **head** with its facial line : transfacial line :: 59: 76, axial line : temporal line :: 31: 20. malar line : joint 3 of antennae :: 2: 10, ocellocipital line : greatest diameter of lateral ocellus :: 3.5: 5.5, elevated portion of malar space nearly as long as depressed portion, head mostly covered with whitish hairs, front distinctly, longitudinally reticulate striate, not elevated into a welt along the

fovea, fovea at most : ocellocular line :: 10: 14, foveal band virtually wanting at upper end of the inner eye margin, distance between fovea and ocelli : ocellocular line :: 4: 14, fovea hardly attenuated below its middle where it is apparently nearly as wide as the greatest width of the fovea, the latter continued to a point apparently half-way between the clypeal line and the antennal line, fovea with the upper two-thirds filled with pale cocoa brown hairs, the lower third with white hairs, vertex and temples along the upper edge of the eye with brownish or black hairs, face mostly shiny, partly indistinctly reticulate, with shallow punctures that are from adjoining to as many as three puncture widths apart, foveae with some long brownish hairs, clypeus slightly elevated above the apical margin, convex, sculptured like the face except that the surface is somewhat rippled and the punctures are more pit-like and not adjoining but from one to two puncture widths apart, clypearea wanting, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea emarginate, its width at base : length down the middle :: 11: 6, width at apex: length down the middle :: 3: 6, greatest length : length down the middle :: 7: 6, labrarea at base nearly half as wide as the labrum, basal half of labrarea with sloping sides, apical half with parallel sides, labrum with a fringe of golden hairs, labrum without structure or definite sculpture between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 10: 8, joints 4 and 5 thicker than long, the succeeding joints as thick as long or little longer than thick, except joint 12 which is distinctly longer than thick, antennae blackish throughout, mandibles typical, robust, extending beyond the outer edge of the labrum, black except for the apical half which is mostly dark reddish, palpi typical; **thorax** covered with an abundance of pale whitish hairs which are nearly as long on the dorsulum where they are darker than the almost white hairs on the mesopleura, dorsulum dullish, coarsely reticulated, notauli represented by a shining line, mesopleura sculptured like the dorsulum but more coarsely, scutel hairy and sculptured much like the dorsulum, metanotum hairy and sculptured like the dorsulum except that the sculpture is denser and less distinct, tegulae dark brown, polished, wing base partly blackish brown, subcosta blackish brown, stigma dark brown, rest of veins dull stramineous, with a blackish tinge, first recurrent vein received by the second submarginal cell a little farther from the first transverse cubitus than the first transverse cubitus is long, nervulus not interstitial, received by the median cell and forming an acute angle with the second abscissa of the median vein, membrane uniformly tinged with brown, legs brownish or blackish brown, covered with brownish golden and whitish hairs, scopa nearly typical, loose, its hairs of the lower two-thirds whitish, almost white, of its upper third with a brownish hue, hairs at base above decidedly darkened, hind metatarsi at most apparently a little narrower than mid metatarsi; **propodeum** with its enclosure poorly defined, shiny and sculptured by means of crooked rugae and a median longitudinal carina, rest of upper face of propodeum sculptured somewhat like the dorsulum but with smaller meshes, and covered with nearly white hair propodeal pleura with sparse shallow punctures, finely reticulate and not hidden by the almost white floccus; **abdomen** with its tergum shiny except the dullish tergite, punctured and finely reticulated, the punctures from two to four puncture widths apart on the first tergite

and set off by a rim to each puncture, the punctures closer on the succeeding tergites and not rimmed, second, third and fourth tergites without hair bands, apical edge of first, second, third and fourth tergites with a brownish stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 17: 9, fifth tergite indistinctly reticulate, its punctures more distinct than on the other tergites, pygidium black, nearly planate, nearly truncate at apex, tergum with inconspicuous, nearly erect, whitish hairs, fimbria brownish.

**Andrena (Ptilandrena) biscutellata** new species

*Type*.—No. 4067, The Academy of Natural Sciences of Philadelphia. Type locality.—Fedor, Lee County, Texas. April 1, 1902. (G. Birkmann.)

Related to A. (*P.*) *haynesii* Viereck and Cockerell.

Female.—Length 15 mm.; **body** black, mostly covered with pale ochreous and almost white hairs; **head** with its facial line : transfacial line :: 73: 96, axial line : temporal line :: 40: 26, malar line : joint 3 of antennae :: 3: 12, elevated portion of malar space virtually wanting, ocelloccipital line : greatest diameter of lateral ocellus :: 8: 5, head covered with whitish hairs, front striato-punctate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 13: 19, foveal band present and at upper end of the inner eye margin : ocellocular line :: 2: 19, distance between fovea and ocelli : ocellocular line :: 4: 19, fovea attenuated below its middle where it is apparently only a little narrower than the greatest width of the fovea, the latter continued to a plane apparently a little below the antennal line, fovea filled with very pale ochreous, almost white, hairs, fovarea wanting, face mostly polished or almost polished, partly indistinctly reticulate, with shallow ill-defined punctures that are mostly from adjoining to two puncture widths apart, clypeus distinctly elevated above the apical margin, convex, with better defined punctures than on the face, the punctures mostly from one to two puncture widths apart, clypearea barely indicated, clypeus thickly hairy on each side of the clypearea, its sculpture almost hidden by the hairs, labrarea deeply almost triangularly emarginate, its width at base : its greatest length :: 15: 5, distance between lower corners : length down the middle :: 4.5: 3, distance between lower corners of clypeus : width of labrarea at base :: 25: 15, labrum with a fringe of pale golden hairs, labrum apparently without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 12: 9, joints 4 and 5 thicker than long, the succeeding joints from a little thicker than long to a little longer than thick except joint 12 which is distinctly longer than thick, antennae blackish to castaneous throughout, mandibles typical, robust, extending to beyond lower corners of the clypeus, dark castaneous except for a subapical blackish stain, palpi nearly typical; **thorax** covered with an abundance of whitish hairs, except on the dorsulum where the hairs are dark ochreous or nearly fulvous, the hairs on the dorsulum so densely plumose and close together as to conceal the sculpture, and apparently not more than one-third as long as the whitish hairs on the mesopleura, dorsulum where denuded,

shiny, finely indistinctly reticulated and finely, closely punctured, the punctures mostly adjoining or nearly adjoining, notauli represented by a shiny line, mesopleura punctured and finely reticulated, the punctures mostly two to four puncture widths apart, scutel nearly bare and almost polished, finely, indistinctly punctured, metanotum thinly hairy and not much more sculptured than the scutel, tegulae mostly brownish stramineous, partly polished, wing base brownish stramineous, partly with a blackish tinge, subcosta black, stigma dull stramineous with its lower boundary blackish, rest of veins dull stramineous, first recurrent vein received by the second submarginal cell before the middle and as near or nearly as near to the first transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus almost interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane uniformly tinged with brown, legs blackish except for the tarsi which are more or less dark brown, legs covered with whitish or pale golden hairs, scopa atypical, its hairs very plumose, pale ochreous and so densely arranged as to nearly hide the tegument, hairs at base above not appreciably darkened, greatest width of hind metatarsi : greatest width of middle metatarsi :: 15: 19; **propodeum** with its enclosure poorly defined, shiny and finely reticulated, except in the middle at base where it is somewhat wrinkled, rest of upper face of propodeum sculptured somewhat like the mesopleura but more densely, and covered with finer whitish hair, propodeal pleura shiny, with sparse shallow punctures and finely reticulated, propodeal floccus whitish; **abdomen** with its tergum shiny almost polished and punctured, the punctures fine and mostly from four to eight puncture widths apart on the first tergite, the punctures a little larger and much closer on the succeeding tergites, first, second, third, and fourth tergites with an apical, whitish hair band that is interrupted in the middle of the first, apical edge of first, second, third, and fourth tergites with a broad pale stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 20: 15, fifth tergite dullish, reticulate, its punctures closer together and coarser than on the other tergites, pygidium nearly planate, rather coarsely sculptured, rounded at apex and with converging sides, tergum with inconspicuous, pale, nearly appressed hairs in addition to the hair bands, fimbria pale, dull, golden on the fifth tergite, bright yellowish golden on each side of the pygidium.

**Andrena** (**Ptilandrena**) **determinata**[8] new species

*Type.*—No. 4070, The Academy of Natural Science of Philadelphia. Type locality.—North Andover, Massachusetts, August 18, 1865. (J. H. Emerton.)

Related to *A.* (*P.*) *biscutellata* Viereck.

Female.—Length 9.5 mm.; **body** black, mostly covered with whitish hairs; **head** with its facial line : transfacial line :: 46: 62, axial line : temporal line :: 25: 14, malar line : joint 3 of antennae :: 1: 8, ocelloccipital line : greatest diameter of lateral ocellus :: 6: 4, elevated portion of malar space virtually wanting, head covered with whitish hairs, front elevated medially, rather

[8] This specific name was proposed for this species by Prof. W. M. Davis.

indistinctly, longitudinally striate and distinctly punctured, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 9: 13, foveal band virtually wanting at upper end of the inner eye margin, distance between fovea and ocelli : ocellocular line :: 3: 13, fovea somewhat attenuated below its middle and continued to a plane apparently a little below the antennal line, fovea filled with dull whitish, almost ochreous hairs, fovarea wanting, face shiny, indistinctly reticulate, with distinct punctures that are mostly from one to three or four puncture widths apart, clypeus distinctly elevated above the apical margin, convex, sculptured like the face except that the punctures are larger and mostly from two to six puncture widths apart, clypearea present but poorly defined, clypeus thinly hairy its sculpture not at all hidden by hairs labrarea deeply triangularly emarginate, its width at base : length down the middle :: 5: 2, width at apex : length down the middle :: 3.5: 2, greatest length : width at base :: 4: 5, distance between lower angles of clypeus : width of labrarea at base :: 18: 5, labrum with a fringe of golden hairs and without a median longitudinal crista between its apical edge and the labrarea, joint 3 of antennae : 4+5 :: 8: 5, joints 4 and 5 much thicker than long, the succeeding joints from a little thicker than long to as long as thick except joint 12 which is distinctly longer than thick, antennae very dark blackish brown throughout, mandibles typical, robust, extending to beyond the corners of the clypeus, blackish brown except for the apical half which is reddish brown, palpi nearly typical; **thorax** thinly covered with almost white hairs which are shorter on the dorsulum than on the mesopleura, dorsulum shiny, sculptured much like the clypeus, but not so shiny, notauli represented by a shiny line, mesopleura sculptured somewhat like the dorsulum but not so distinctly punctured and with a loose network of carinae, scutel hairy and sculptured much like the dorsulum, metanotum hairy and sculptured like the dorsulum except that the sculpture is denser and less distinct, tegulae dark brownish stramineous, shiny and finely reticulated, wing base partly blackish brown, subcosta blackish brown, stigma pale brownish stramineous with a dark brown margin, rest of veins dull brownish stramineous, first recurrent vein received by the second submarginal cell a little before the middle and nearly as near to the first transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus almost exactly interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane with a uniform brownish tinge, legs dark brown except for the small joints of the tarsi which are more or less dark stramineous, legs covered with golden and whitish hairs, scopa atypical, its hairs branched and forming a brush so dense as to almost obscure the tegument, its hairs golden except at base above where they are decidedly darkened, hind metatarsi at most : mid metatarsi :: 8: 9.5; **propodeum** with its enclosure poorly defined, dullish and very finely reticulated and with an indistinct network of carinae at base, rest of upper face of propodeum sculptured somewhat like the mesopleura, and covered with finer whitish hair, propodeal pleura shiny, finely reticulated and with sparse shallow punctures, the propodeal floccus whitish; **abdomen** with its tergum dullish finely sculptured and sparsely punctured, the punctures mostly from two to six puncture widths apart on the first tergite, the punctures closer on the succeeding tergites, first, second, third, and fourth tergites with

an apical, whitish hair band, apical edge of first, second, third, and fourth tergites with a stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 15: 9, fifth tergite shining, reticulate, its punctures coarser but not as close together as on the preceding tergite, pygidium nearly planate, slightly elevated down the middle, turned up along the edge and nearly pointed at apex, tergum with inconspicuous, pale and dark appressed hairs in addition to the hair bands, fimbria golden brown.

**Andrena** (**Ptilandrena**) **tonkaworum** new species

1904. *Andrena melliventris* Howard, The Insect Book, pl. IV, fig. 3.

*Type.*—No. 4074, The Academy of Natural Sciences of Philadelphia. Type locality.—Texas. (No. 220, Belfrage.)

Related to *A.* (*P.*) *nivaloides* Graenicher.

Female.—Length 12.5 mm.; **body** black, mostly covered with pale ochreous, almost white hairs; **head** with its facial line : transfacial line :: 70: 88, axial line : temporal line :: 37: 20, malar line: joint 3 of antennae :: 2: 12, ocelloccipital line : greatest diameter of lateral ocellus :: 9: 6, elevated portion of malar space virtually wanting, head covered with pale ochreous, almost white, hairs, front dullish, finely reticulated and closely punctured, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 11: 16, foveal band virtually wanting, distance between fovea and ocelli : ocellocular line :: 4: 16, fovea hardly attenuated below its middle and continued to a plane distinctly above the antennal line, fovea filled with pale ochreous hairs, fovarea wanting, face shiny, finely reticulate and with shallow punctures that are as many as four puncture widths apart, clypeus slightly elevated above the apical margin, convex, sculptured like the face except that the punctures are larger and better defined, clypearea present but poorly defined, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea triangularly emarginate, its width at base : length down the middle :: 15: 4, width at apex : length down the middle :: 5: 4, greatest length : length down the middle :: 6: 4, labrarea at base : distance between lower corners of clypeus :: 15: 25, labrum with a fringe of golden hairs, labrum without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 12: 8, joints 4 to 9 thicker than long, the succeeding joints as thick as long or a little longer than thick except joint 12 which is apparently one and one-half times as long as thick, antennae dark brown to blackish throughout, mandibles typical, robust, extending to beyond the lower corners of the clypeus, black except for the apex and middle which are dark reddish, palpi nearly typical; **thorax** having dorsulum covered with an abundance of ochreous, almost fulvous hairs, which are shorter than the almost whitish hairs on the mesopleura, dorsulum dullish, finely reticulated and punctured like the face but more distinctly so, notauli represented by a shiny line, mesopleura sculptured somewhat like the dorsulum, scutel hairy and sculptured much like the dorsulum, metanotum hairy and sculptured like the dorsulum except that the hairs are paler, tegulae pale stramineous, polished, wing base partly brownish, subcosta blackish brown, stigma pale stramineous, rest of veins paler stramineous, first recurrent vein received by the second submarginal cell before the middle and as near to the

first transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane with a uniform yellowish tinge, legs brownish to blackish brown and covered with brownish golden and ochreous hairs, scopa atypical, its hairs branched, pale ochreous and forming a dense brush, hind metatarsi at most apparently as wide as the middle metatarsi; **propodeum** with its enclosure poorly defined, dullish and finely reticulated, rest of upper face of propodeum sculptured somewhat like the mesopleura but with less distinct punctures, and covered with finer pale ochreous hair, propodeal pleura with a few shallow punctures, propodeal floccus pale golden; **abdomen** with its tergum shiny and sculptured much like the face, the punctures mostly from two to six puncture widths apart on the first tergite, the punctures hardly closer on the succeeding tergites, tergites with an apical, almost whitish straminеous margin, second, third and fourth tergites with an apical pale golden hair band, second tergite with its elevated portion down the middle : depressed portion :: 29: 12, fifth tergite shiny, reticulate, its punctures coarser and closer together than on the other tergites, pygidium nearly planate, without a shallow furrow on each side, nearly truncate at apex, tergum with inconspicuous, pale, nearly erect hairs in addition to the hair bands, fimbria bright golden.

**Andrena (Ptilandrena) yaquiorum** new species

*Type*.—No. 4053, The Academy of Natural Sciences of Philadelphia. Type locality.—Mexico. (No further data.)

Related to *A. (P.) erigenoides* Viereck.

Male.—Length 7.5 mm.; **body** black, mostly covered with white hair; **head** with its facial line : transfacial line :: 49: 59, axial line : temporal line :: 24: 13, temples trapezoidal, almost rounded, malar space virtually crowded out between the eye and the base of the mandibles, head covered with white hairs except along the inner eye margin, upper eye margin, and outer eye margin above the middle of temples and on front where the hairs are black, front striato-punctuate, shiny, ocellocular line : ocelloccipital line :: 11: 4, face polished, distinctly punctured, its punctures from one to three puncture widths apart, clypeus nearly planate, clypeus apparently slightly convex near apex, polished, and more sparsely punctured than the face, not much elevated directly above the apical margin, clypearea virtually wanting, sculpture of the clypeus not hidden by the moustache, labrarea with a broad rounded emargination, polished, its width at base : greatest length :: 8: 4, width at apex : length down the middle :: 4: 3, labrarea at base nearly half as wide as the labrum, the latter with a fringe of brownish golden hairs, joint 3 of antennae : 4 :: 6: 4, joint 4 a little thicker than long, joint 5 as long as thick, joints 6 to 11 inclusive a little longer than thick, the end joint nearly twice as long as thick, antennae dullish, flagel almost straight in outline, antennae blackish brown throughout, mandibles atypical, rather robust, extending to the outer edge of the labrum and nearly to end of the basal third of its fellow, black except for the apical third which is reddish brown, palpi nearly typical; **thorax** covered with an abundance of white hairs, hairs of dorsulum mostly black and shorter than the hair of

mesopleura, dorsulum polished, sparsely punctured, the punctures minute and from three to five or more puncture widths apart, mostly the latter, notauli represented by a linear elevation of the tegument, mesopleura polished, with black hairs throughout, with distinct punctures that are from adjoining to three puncture widths apart, scutel hairy and sculptured much like the dorsulum, except that a discal area on each side of the middle line is nearly bare and nearly sculptureless, metanotum with white hair, shiny and sparsely punctured, tegulae brownish stramineous, polished, wing base mostly dark brownish stramineous, subcosta blackish brown, stigma dark brown with a blackish brown margin, first recurrent vein received by the second submarginal cell in or a little beyond the middle and distinctly farther from the second transverse cubitus than the first transverse cubitus is from the stigma on the radial vein, nervulus interstitial, forming an acute angle with the first abscissa of the discoidal vein, membrane tinged with brown, the radial cell contrastingly with a dark brown cloud, legs blackish brown excepting the middle and hind femora which are reddish brown, legs covered with whitish and brownish hairs, hind metatarsi at most hardly wider than middle metatarsi and nearly half as wide as hind tibiae at apex of the latter; **propodeum** with its enclosure poorly defined, with irregular concentric nearly transverse striae at base, elsewhere nearly polished, rounded off at apex, rest of upper face sculptured somewhat like the mesopleura but with smaller sparser punctures and covered with white hair, propodeal pleura along the upper edge sculptured apparently like the mesopleura, elsewhere impunctate and feebly reticulated, the sculpture not hidden by the uniformly distributed white hairs; **abdomen** with its tergum polished, sparsely minutely punctured, the punctures from two to many puncture widths apart, first and second tergites with erect whitish hairs, third, fourth and fifth tergites with sub-appressed blackish hairs, second tergite with its elevated portion down the middle : depressed portion :: 11: 6, apical edge of tergites pale stramineous, anal process broadly truncate at apex, tergum with rather inconspicuous hairs, that are supplemented on the apical margin of the first, second, third and fourth tergites by distinct whitish hair bands, hair at apex of abdomen of a brownish hue.

**Andrena** (**Scrapter**) **imitatrix** var. **profunda** new variety

1909. *Andrena texana profunda* Viereck in Pierce, Rev. Strepsiptera, p. 195.

*Type*.—No. 4064, The Academy of Natural Sciences of Philadelphia. Type locality.—Fedor, Lee County, Texas. March 22, 1905. (G. Birkmann.) Also February 18, 1898. (G. Birkmann.)

Related to *A.* (*S.*) *imitatrix* var. *texana* Cresson, from which it differs in the fulvous or ochreous pubescence.

Other localities.—Georgia (H. K. Morrison); North Carolina (H. K. Morrison); Texas (Belfrage); N. Illinois (Nason); Colorado City, Colorado, May 10, at flowers of *Prunus* (W. P. & T. D. A. Cockerell).

**Andrena (Scrapter) morrisonella** new species

*Type.*—No. 4061, The Academy of Natural Sciences of Philadelphia. Type locality.—Georgia. (H. K. Morrison.)

Related to *A.* (*S.*) *imitatrix* Cresson.

Female.—Length 8.5 mm.; **body** black, mostly covered with pale ochreous or whitish hairs, **head** with its facial line : transfacial line :: 55: 63, axial line : temporal line :: 27: 13, malar line : joint 3 of antennae :: 1: 7, elevated portion of malar space virtually wanting, head covered with whitish hairs, front shiny and striato-punctate, the punctures from one to three puncture widths apart, not elevated along the inner foveal edge, fovea at most : ocellocular line :: 10: 10, fovea virtually contiguous to the upper end of the inner eye margin, fovea adjoining ocelli, fovea decidedly constricted near its middle where it is apparently only a little more than half as wide as the greatest width of the fovea, the latter continued below the constriction as a nearly parallel-sided furrow down to a point apparently on the clypeal line, fovea pale ochreous throughout, fovarea poorly developed, represented by a narrow, beveled, shiny space along the outer edge of the lower half of the fovea, face shiny, with large adjoining and nearly adjoining clear cut punctures, clypeus slightly elevated above the apical margin, convex, shiny and punctured much like the face, polished down the middle, clypearea poorly developed, represented by a median impunctate line, clypeus thinly hairy, its surface not at all hidden by hairs, labrarea subemarginate, width at base: length down the middle :: 10: 3, width at apex : length down the middle :: 4.5: 3, labrarea at base a little more than one third as wide as the labrum, the latter with a fringe of pale golden hairs, joint 3 of antennae : 4+5 :: 7: 8.5, joint 4 as thick as long, the succeeding joints apparently a little longer than thick, antennae blackish throughout, mandibles typical, robust, extending nearly to the outer edge of the labrum, black except for the apical half which is mostly dark reddish, palpi typical; **thorax** covered with an abundance of pale hairs which are ochreous on the dorsulum where they are shorter than the whitish hairs on the mesopleura, dorsulum dullish, finely reticulated, coarsely punctured, the punctures ranging from adjoining to two puncture widths apart, notauli represented by an elevated shiny line, mesopleura with whitish hairs, except along the upper margin where the hairs are pale ochreous, finely reticulated and more deeply and more coarsely punctured than the dorsulum, the punctures mostly adjoining, scutel hairy and sculptured much like the dorsulum except for being more coarsely punctured and having coarser hairs, metanotum hairy and sculptured like the dorsulum except that the sculpture is dense and the hairs closer together, tegulae dark brown, partly polished, wings with three submarginal cells, wing base dark brown, subcosta from pale to blackish brown, stigma pale brownish stramineous with a yellowish border, rest of veins dull stramineous with a blackish tinge, first recurrent vein received by the second submarginal cell beyond the middle and nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus received by the median cell and forming a nearly acute angle with the second abscissa of the median

vein, legs dark brown except for the mid and hind tarsi and hind tibiae which are more or less yellowish stramineous, legs covered with pale golden or whitish hairs, scopa typical, its hairs of a golden hue, and concolorous throughout, with the hairs at base above slightly darkened, hind metatarsi at most apparently a little wider than mid metatarsi; **propodeum** with its enclosure well defined by a trenchant carina, shiny and with coarse crooked rugae on each side of a median longitudinal carina, rest of upper face of propodeum sculptured somewhat like the enclosure but not so coarsely, and covered with whitish hair, propodeal pleura with a few shallow finely reticulate excavations on their posterior half, sparsely punctured and finely reticulated on their anterior half, not hidden by the whitish floccus; **abdomen** with its tergum polished or nearly so, punctured, the punctures clear cut but small, from two to many puncture widths apart on the first tergite, from one to three or four puncture widths apart on the elevated portion of the second, third and fourth tergites where the punctures are not so close together as on the depressed portions, second tergite with its elevated portion down the middle : depressed portion :: 12: 9, fifth tergite shiny, reticulate, with its punctures from adjoining to four puncture widths apart, pygidium brownish, planate, rounded at apex, tergum with inconspicuous pale hairs, second, third and fourth tergites with an apical whitish hair band that is broadly interrupted on the second and third, fimbria golden.

Other locality.—Beltsville, Maryland. June 14, 1914. (W. L. McAtee.)

**Andrena** (**Scrapter**) **neonana** new species

*Type*.—No. 4062, The Academy of Natural Sciences of Philadelphia. Type locality.—Georgia. (H. K. Morrison.)

Related to *A.* (*A.*) *personata* Robertson, but placed in the subgenus *Scrapter* because of the antennae.

Female.—Length 6.5 mm.; **body** black, mostly covered with pale ochreous almost white hairs; **head** with its facial line : transfacial line :: 38: 46, axial line : temporal line :: 20: 11, elevated portion of malar space nearly as long as depressed portion, malar line : joint 3 of antennae :: 1: 4, ocelloccipital line : greatest diameter of lateral ocellus :: 2.5 : 3.5, head covered with whitish hairs, front rather indistinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 5: 8, foveal band represented at upper end of the inner eye margin by a beveled bare margin, distance between fovea and ocelli : ocellocular line :: 3: 8, fovea nearly parallel-sided throughout and continued below to a plane apparently a little below the antennal line, fovea filled with pale ochreous hairs, fovarea wanting, vertex and temples along the upper edge of the eye with pale ochreous hairs, face nearly polished, partly indistinctly reticulate, with indistinct punctures that are as many as five or more puncture widths apart, clypeus distinctly elevated above the apical margin, convex, sculptured like the face except that the punctures are larger and well defined, clypearea present but poorly defined, clypeus thinly hairy,

its sculpture not at all hidden by hairs, labrarea rounded, nearly semicircular in outline, its width at base : length down the middle :: 9: 3, labrarea at base: distance between lower clypeal corners as 9: 14, labrum with a thin fringe of golden hairs, labrum apparently without a median longitudinal crista between its apical edge and the labrarea, joint 3 of antennae : 4+5 :: 4: 6, joints 4 and 5 thicker than long, the succeeding joints as thick as long or a little longer than thick except joints 11 and 12 which are distinctly longer than thick, antennae from pale to blackish brown, paler beneath than above, mandibles typical, robust, extending to a little beyond the outer edge of the labrarea, dark reddish except for the basal third which is partly blackish, palpi nearly typical, greatest thickness of 2nd joint of maxillary palpi : length of the same joint :: 1: 3.5; **thorax** covered with an abundance of pale ochreous, almost white hairs which are as long on the dorsulum as the hairs on the mesopleura, dorsulum shiny, finely reticulated and punctured like the face but more distinctly so, notauli represented by a faint shiny line, mesopleura sculptured somewhat like the dorsulum but not so closely punctured, scutel hairy and nearly polished, its punctures spaced as on the dorsulum, the punctures however smaller and more sharply defined, metanotum hairy and sculptured like the dorsulum except that the sculpture is denser and less distinct, tegulae pale stramineous, partly polished, wing base dull stramineous, subcosta brownish, stigma pale stramineous, its lower margin brownish, rest of veins dull stramineous, with a blackish tinge, first recurrent vein received by the second submarginal cell beyond the middle and nearly twice as far from the second transverse cubitus as the first transverse cubitus is from the stigma on the radial vein, nervulus received by the median cell and forming an acute angle with the second abscissa of the median vein, membrane uniformly with a pale stramineous tinge, legs brownish except for the tarsi which are more or less pale stramineous, legs covered with pale ochreous and whitish hairs, scopa atypical, its hairs sparse, loosely arranged and whitish except at base above where they are golden, hind metatarsi apparently a little wider than middle metatarsi; **propodeum** with its enclosure poorly defined, shiny and finely reticulated, except for a network of coarse rugae, rest of upper face of propodeum sculptured somewhat like the enclosure but with a much finer network of carinae, and with fine pale ochreous hair, propodeal pleura finely reticulate and with sparse shallow punctures not almost hidden by the whitish floccus; **abdomen** with its tergum shiny and sculptured much like the metapleura, the punctures of the first tergite so sparse and indistinct as to appear wanting, the punctures hardly more evident on the succeeding tergites, second, third, and fourth tergites with a thin, apical, fringe of pale ochreous hair, not appearing banded, apical edge of first, second, third, and fourth tergites stramineous, second tergite with its elevated portion down the middle : depressed portion :: 10: 6, fifth tergite shiny, reticulate, its punctures closer together and more distinct than on the other tergites, pygidium nearly planate, with a shallow furrow on each side, truncate at apex, tergum with inconspicuous, pale appressed hairs in addition to the fringes, fimbria pale golden with a faint brownish tinge.

**Andrena (Scrapter) trapezoidea** new species

*Type*.—No. 4075, The Academy of Natural Sciences of Philadelphia. Type locality.—Texas. (Belfrage No. 227.)

Related to *A.* (*S.*) *imitatrix* Cresson.

Female.—Length 7 mm.; **body** greenish black, mostly covered with white hairs with a more or less ochreous tinge; **head** with its facial line : transfacial line :: 40: 52, axial line : temporal line :: 22: 11, malar line : joint 3 of antennae :: 1: 5, ocelloccipital line : greatest diameter of lateral ocellus :: 5: 3.5, elevated portion of malar space virtually wanting, head covered with white hairs, front rather indistinctly, longitudinally striate, not elevated into a welt along the fovea, fovea at most : ocellocular line :: 6: 9, foveal band wanting at upper end of the inner eye margin, distance between fovea and ocelli : ocellocular line :: 3: 9, fovea attenuated below its middle where it is apparently only one-half or a little more than half as wide as the greatest width of the fovea, the latter continued to a plane apparently a little below the antennal line, fovea filled with pale, almost white hairs, fovarea wanting, face shiny, finely indistinctly reticulate, with shallow punctures that are as many as three puncture widths apart, clypeus elevated above the apical margin, convex, its basal half finely reticulated and with punctures that are three to four or five puncture widths apart, its apical half mostly polished and with larger but equally sparse punctures as on the basal half, clypearea poorly defined, clypeus thinly hairy, its sculpture not at all hidden by hairs, labrarea rounded truncate, its width at base : length down the middle :: 7: 2, width at apex : length down the middle :: 3: 2, labrarea at base : distance between lower angles of clypeus :: 7: 15, labrum with a fringe of pale golden hairs, labrum without a median longitudinal crista between the labrarea and apical edge of labrum, joint 3 of antennae : 4+5 :: 5: 6, joints 4 to 6 thicker than long, the succeeding joints as thick as long or a little longer than thick except joint 12 which is nearly twice as long as thick, antennae granular, with scape, pedicel, first joint of flagel and rest of flagel above more or less dark brown, rest of flagel orange color, mandibles typical, robust, extending to the outer lower angle of the clypeus, reddish brown except for the basal half which is blackish, palpi nearly typical; **thorax** thinly covered with almost white hairs that are nearly as long on the dorsulum as on the mesopleura, dorsulum nearly polished, purplish, finely reticulated and punctured like the clypeus, notauli represented by a shiny line, mesopleura with whitish hairs, densely reticulated and with shallow indefinite punctures, scutel hairy, polished and sculptured much like the dorsulum, metanotum hairy, mostly dullish, reticulated and sparsely punctured, tegulae dark brown, polished, wings with three closed submarginal cells, wing base brownish, subcosta brownish stramincous, stigma pale yellowish stramineous, rest of veins pale dull stramineous, first recurrent vein received by the second submarginal cell beyond the middle and farther from the second transverse cubitus than the first transverse cubitus is from the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, membrane almost colorless and with a

yellowish tinge, legs dark brown except for the hind tibiae, hind tarsi and small joints of fore and mid tarsi which are more or less pale brownish stramineous, legs covered with whitish and pale golden hairs, scopa atypical, its hairs whitish and arranged in much the same way as in *A.* (*A.*) *nasoni* Rob., hairs at base above also whitish, hind metatarsi at most apparently a little wider than mid metatarsi; **propodeum** with its enclosure poorly defined, shiny and finely reticulated, rest of upper face of propodeum sculptured somewhat like the mesopleura and covered with finer whitish hair, propodeal pleura with sparse shallow punctures, floccus white; **abdomen** with its tergum polished and sculptured much like the dorsulum but with smaller punctures and only slightly if at all metallic, the punctures from one to six or more puncture widths apart on the first tergite, the punctures closer on the succeeding tergites, mostly from one to three puncture widths apart and larger than on the first tergite, second, third and fourth tergites with an apical, whitish hair band, apical edge of first, second, third and fourth tergites with a pale stramineous border, second tergite with its elevated portion down the middle : depressed portion :: 12: 7, fifth tergite shining, reticulate, its punctures closer together than on the other tergites, pygidium nearly planate, somewhat concave, rounded at apex, tergum satiny with inconspicuous appressed whitish hairs in addition to the hair bands, fimbria pale golden. In a paratype, from the same source as the type and with the same collector's number as the type, the tergites, clypeus and edge of parts adjoining the clypeus are more or less brown.

*Allotype.*—No. 4075, The Academy of Natural Sciences of Philadelphia. Fedor, Lee County, Texas, March 24, 1902. (G. Birkmann.)

Male.—Length 5.5 mm.; **body** black with a faint greenish or purplish tinge, mostly covered with whitish hair; **head** with its facial line : transfacial line :: 40: 50, axial line : temporal line :: 21: 10, temples not produced, rounded, malar line : joint 3 of antennae :: 1 : 4, elevated portion of malar space virtually wanting, head covered with whitish hairs throughout, front dullish, finely reticulated and finely longitudinally striate, ocellocular line : ocellocipital line :: 9: 2.5, face shiny, indistinctly punctured, its punctures mostly from adjoining to one or two puncture widths apart, clypeus convex, more shiny and more distinctly punctured than the face, elevated directly above the apical margin, clypearea wanting, clypeal punctures as many as six puncture widths apart, sculpture of the clypeus not hidden by the moustache, labrarea subemarginate, polished, its width at base : greatest length :: 6: 2, width at apex : length down the middle :: 2.5: 1.5, labrarea at base : distance between lower angles of clypeus :: 6: 12, labrum with a fringe of pale hairs, joint 3 of antennae : 4 :: 4: 5, joint 4 : 5 :: 5: 7, joint 5 and following joints nearly one and one-half times as long as thick, shiny, flagel, undulate in outline, antennae brownish throughout, mandibles atypical, robust, extending beyond the lower corners of the clypeus and nearly to end of the basal third of their fellow, black except for the apical half which is mostly dark reddish, palpi nearly

typical; **thorax** covered with an abundance of whitish hairs, hairs on dorsulum seemingly as long as the hair of mesopleura, dorsulum shiny, partly polished and purplish, finely reticulated, sparsely punctured, the punctures distinct and mostly from two to five puncture widths apart, mostly the latter, notauli represented by a shiny line, mesopleura shiny, almost dullish, with whitish hairs throughout, finely reticulated and mostly covered with shallow punctures that are mostly three or more puncture widths apart, scutel hairy, colored and sculptured much like the dorsulum but not so polished, metanotum black, hairy and sculptured like the scutel except that the sculpture is denser and less shiny, tegulae dark brown, polished, wing base mostly brownish stramineous, subcosta pale brownish stramineous, stigma yellowish stramineous with a brownish margin, first recurrent vein received by the second submarginal cell a trifle beyond the middle but not as near to the second transverse cubitus as the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial, forming an acute angle with the first abscissa of the discoidal vein, membrane with a uniform yellowish tinge, legs blackish brown excepting the small joints of the tarsi which are rather pale stramineous, legs covered with whitish hairs, hind metatarsi at most a little wider than middle metatarsi and nearly half as wide as hind tibiae at apex of the latter; **propodeum** with its enclosure poorly defined, finely reticulated throughout, rounded off at apex, rest of upper face sculptured somewhat like the mesopleura but with less distinct punctures, propodeal pleura sculptured nearly like the mesopleura, propodeal hairs whitish; **abdomen** with its tergum shiny, partly polished, finely reticulated and distinctly punctured, the punctures mostly two or three puncture widths apart, first tergite with erect whitish hairs, second and third tergites with appressed whitish hairs, second tergite with its elevated portion down the middle : depressed portion :: 12:6, third and fourth tergites with whitish appressed hairs throughout, fifth tergite with its basal blackish portion covered with poorly defined punctures that are as many as four or more puncture widths apart, rest of fifth tergite and exposed portion of sixth and seventh tergites with a stramineous margin, anal process narrow, nearly hour-glass shaped, rounded at apex, and with a submarginal transverse carina, tergum with rather inconspicuous hairs, subfasciate, hair at apex of abdomen of a pale golden hue.

**Andrena (Trachandrena) ceanothi** new species

*Type.*—No. 4063, The Academy of Natural Sciences of Philadelphia. Type locality.—Lehigh Gap, Lehigh County, Pennsylvania. June 29, 1901, on flowers of *Ceanothus americanus* L. (H. L. Viereck.)

Related to *A. (T.) radiatula* Cockerell.

Female.—Length 10.5 mm.; **body** black, mostly covered with pale ochreous hairs; **head** with its facial line : transfacial line :: 63:69, axial line : temporal line :: 33:22, malar line : joint 3 of antennae :: 1:7, elevated portion of malar space virtually wanting, head covered with pale ochreous, almost whitish hairs,

front polished and punctured, the punctures as many as three puncture widths apart but mostly adjoining or one puncture width apart, front distinctly elevated along the inner eye margin, fovea at most : ocellocular line :: 10: 13, foveal band wanting, fovea virtually contiguous to the upper end of the inner eye margin, distance between fovea and ocelli : ocellocular line :: 2: 13, fovea decidedly constricted near its middle where it is apparently only one-third as wide as the greatest width of the fovea, the latter continued below the constriction as a narrowing furrow down to a plane apparently a little below the clypeal line, foveal hairs very pale ochreous, fovarea widest a little above the middle of the fovea, angulated at its widest point where it is a little wider than the fovea is wide opposite the angulation of the fovarea, the latter polished and with a few poorly defined punctures, face polished and with large adjoining and nearly adjoining punctures, clypeus slightly elevated above the apical margin, convex, polished and punctured, the punctures as many as eight puncture widths apart, clypearea virtually wanting, clypeus thinly hairy, labrarea truncate, width at base : length down the middle :: 14: 4, width at apex : length down the middle :: 7: 4, labrarea at base : distance between lower angles of clypeus :: 14: 20, labrum with a fringe of golden hairs, joint 3 of antennae : 4+5 :: 7: 10, joint 4 thicker than long, the succeeding joints from as long as thick to longer than thick, antennae blackish brown throughout, mandibles typical, robust, extending to the outer edge of the labrarea, black except for the apical third which is mostly dark reddish, palpi nearly typical; **thorax** covered with an abundance of slender hairs which are slightly darker on the dorsulum where they are a little shorter than the paler hairs on the mesopleura, dorsulum partly polished, partly finely reticulated, coarsely punctured, the punctures ranging from nearly adjoining to two puncture widths apart, notauli represented by an impressed dullish line, mesopleura with very pale ochreous hairs except along the upper margin where the hairs are slightly darker, coarsely punctato-reticulate, scutel hairy and sculptured much like the dorsulum, metanotum densely, indefinitely sculptured, tegulae pale stramineous, polished, wing base reddish brown and with a blackish spot, subcosta blackish brown, stigma yellowish stramineous, with its lower margin reddish brown, rest of veins dull brownish stramineous, first recurrent vein received by the second submarginal cell beyond the middle and a little nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus interstitial and forming an acute angle with the first abscissa of the discoidal vein, legs blackish except for the tarsi which are more or less dark brown, covered with pale ochreous, golden and brownish hairs, scopa nearly typical, its hairs of a pale golden hue, and concolorous throughout except for the hairs at base above which are darkened, hind metatarsi at most apparently narrower than the mid metatarsi; **propodeum** with its enclosure poorly defined except at apex where its truncation is bounded by a trenchant carina, the enclosure with at least sixteen nearly longitudinal carinae, the interstices of which are finely reticulated, rest of upper face of propodeum sculptured somewhat like the mesopleura and covered with very pale ochreous hair, propodeal pleura finely reticulated, and sparsely punctured with shallow

punctures that are as many as eight puncture widths apart, propodeal floccus very pale ochreous, nearly whitish; **abdomen** with its tergum polished and densely punctured, the punctures clear cut and mostly adjoining or one puncture width apart on the first tergite, from adjoining to one or two puncture widths apart on the elevated portion of the second, third and fourth tergites where the punctures are a little larger than on the depressed portions and from one to four puncture widths apart on the depressed portions of the second, third, and fourth tergites, second tergite with its elevated portion down the middle : depressed portion :: 10: 18, fifth tergite with its surface finely reticulated and with nearly adjoining deep punctures, pygidium black, brownish at apex, its embossed area planate, the latter area bounded on each side by a deep furrow, pygidium truncate at apex, tergum with inconspicuous pale hairs, first, second, third, and fourth tergites with a broadly interrupted white hair band, fimbria pale golden.

*Allotype*.—No. 21,145, U. S. National Museum, Washington. Based on a specimen collected in Maryland near Plummer's Island, May 10, 1916, on flowers of *Washingtonia* (W. L. McAtee).

Male.—Length 7 mm.; **body** black, mostly covered with bright ochreous hair; **head** covered with bright ochreous hairs throughout, with its facial line : transfacial line :: 46: 54, axial line : temporal line :: 23: 13, temples rounded, malar line : joint 3 of antennae :: 1: 5, elevated portion of malar space virtually wanting, front striato-punctate, its striae indistinct and its punctures rather well defined, ocellocular line : ocelloccipital line :: 10: 4, face polished and with large adjoining, or nearly adjoining punctures, clypeus apparently only slightly elevated directly above the apical margin, convex, polished and punctured much like the face, clypearea barely represented by a slight median longitudinal elevation, sculpture of the clypeus nearly hidden by the moustache, labrarea subemarginate, its width at base : length down the middle :: 7: 2.5, width at apex : length down the middle :: 4: 2.5, the latter length : greatest length :: 2.5: 3, labrarea at base : distance between lower angles of clypeus :: 7: 14, labrum with a fringe of golden hairs, joint 3 of antennae : 4 :: 5: 7.5, joint 4 and following joints from nearly twice as long as thick to one and one-half times as long as thick, end joint twice as long as thick, flagel dullish, flagel somewhat undulate in outline, antennae blackish throughout, mandibles atypical, robust, extending a little beyond the lower corner of the clypeus, black except for the apical third which is very dark reddish, palpi nearly typical; **thorax** covered with an abundance of slender, bright ochreous hairs, hairs of dorsulum somewhat shorter than the hair of mesopleura, dorsulum dullish, finely reticulated and coarsely punctured, the punctures ranging from adjoining to two puncture widths apart, notauli represented by an impressed dullish line, mesopleura with pale ochreous hairs throughout, mostly covered with shallow adjoining pits, scutel hairy and sculptured much like the dorsulum, metanotum hairy and densely sculptured, tegulae dark brownish stramineous, polished, and finely reticulated, wing base mostly blackish brown, subcosta blackish brown, stigma brownish stramineous, rest of veins dull stramineous, first recurrent vein received by the second submarginal cell beyond the middle

and a little nearer to the second transverse cubitus than the first transverse cubitus is to the stigma on the radial vein, nervulus received by the median cell and forming an acute angle with the second abscissa of the median vein, legs blackish excepting the small joints of the tarsi which are rather brownish, legs covered with pale ochreous and reddish hairs, hind metatarsi at most apparently distinctly wider than middle metatarsi and nearly half as wide as hind tibiae at apex of the latter; **propodeum** with its enclosure defined and truncate at apex, finely sculptured in the interstices between the nine or ten coarse and nearly longitudinal carinae, rest of upper face nearly as coarsely carinate as the enclosure but with the carinae forming coarse meshes, and covered with fine pale ochreous hair, propodeal pleura more diffusely reticulate than the mesopleura, propodeal floccus pale ochreous; **abdomen** with its tergum polished, punctured, the punctures small and not clear cut and from two to at least eight puncture widths apart on the first tergite, from one to five or more puncture widths apart on the elevated portion of the second, third, and fourth tergites where the punctures are larger than on the depressed portions where the punctures are also farther apart, second tergite with its elevated portion down the middle : depressed portion :: 9: 9, fifth tergite with its basal blackish portion covered with poorly defined punctures that are as many as four or more puncture widths apart, rest of fifth tergite and exposed portion of sixth and seventh tergites dark stramineous, anal process truncate, with rounded corners, brownish stramineous, tergum with rather inconspicuous pale hairs that are supplemented on the sides of the second, third, and fourth tergites by thin, pale, ochreous, apical hair bands, hair at apex of abdomen pale ochreous or pale golden.

Other localities.—Montgomery County, Maryland, June 12, 1916, a stylopized ♂ on *Ceanothus americanus* L., (J. C. Crawford) (U. S. N. M.); Rutland, Vermont, August 1, 1916, (Chittenden); Lahaway, Ocean County, New Jersey; Ramsey, N. J., June 5, 6, 18, 1916, (Jos. Bequaert), [Am. Mus. Nat. Hist.]; Lehigh Gap, Lehigh County, Pennsylvania, July 26, 1901 (H. L. V.); Manahawkin, New Jersey, May 30, 1910 (V. A. E. Daecke); Milwaukee, Wisconsin, June 6, 1903 (S. Graenicher), No. 1; Iowa, June, No. 1173 (Putnam); Maine (Norton); Giles County, Virginia, [A. N. S. P.]; Woodstock, Virginia, May 29 (N. Banks).

# NOTES ON MEXICAN DERMAPTERA

BY MORGAN HEBARD

The study of a large collection of Dermaptera from Panama[1] has recently necessitated comparison with a number of species represented in the unstudied material of the order from Mexico. As many interesting features are to be found in the Mexican material at hand, we take the present opportunity to record the series. The material is all in the Hebard Collection, with the exception of the few specimens otherwise credited. In addition to the types examined, four hundred and fifty-two specimens are here recorded, representing eighteen genera and twenty-seven species, of which two species are described as new.

It is evident that, in this country, which shows such diversity in both topography and climate, the Dermaptera in many sections are numerous and rich in species. A great number of species undoubtedly still remain to be recorded, while many, already reported as the same as Central and South American species, will probably be found to represent distinct but closely related forms, when sufficient collections have been made.

The preparation of a list of the Dermaptera of Mexico at present would be premature.

## Pygidicranidae

### pygidicraninae

**Pyragra fuscata** Serville (Plate XXVIII, figures 1 and 2.)

1831. *Pyragra fuscata* Serville, Ann. Sci. Nat., xxii, p. 34. [Cayenne.]

San Rafael, Vera Cruz, Mexico, (C. H. T. Townsend), 1 ♂.
Cordoba, Vera Cruz, Mex., XI, 1887, (L. Bruner), 1 ♂.
Fortin, Vera Cruz, Mex., XI, 1887, (L. Bruner), 1 ♀.
Motzorongo, Vera Cruz., Mex., II, 1892, (L. Bruner), 9 juv.
Minatitlan, Vera Cruz, Mex., II, 1892, (L. Bruner), 11 juv.

The adults here recorded all have the tegmina dark and unicolorous. The male from San Rafael is exceptionally heavy for the species, with abdomen expanding slightly distad, disto-dorsal

[1] Trans. Am. Ent. Soc., xliii, pp. 301 to 334, (1917).

abdominal segment subquadrate and forceps extremely heavy (Plate XXVIII, figure 2). Width of disto-dorsal abdominal segment 4.1, length of forceps 4.8, basal width of forceps 1.2 mm. Additional material may show this to be a distinct species; if this proves true Dohrn's name, *saussurei*, is available.

## Labiduridae

### Psalinae

**Anisolabis maritima** (Géné)

1832. *Forficula maritima* Géné, Ann. Sci. Nat. Regn. Lomb. Venet., ii, p. 224. [Nice, France; Genoa and Tuscany, Italy; along Mediterranean.]

Aguascalientes, Aguascalientes, Mexico, I, 1892, (L. Bruner), 1 ♀.

Vera Cruz, Vera Cruz, Mex., I, 1892, (L. Bruner), 1 ♂, 1 ♀.

**Euborellia annulipes** (Lucas)

1847. *Forficelisa annulipes* Lucas, Bull. Soc. Ent. France, (2), v, p. XXXIV. [Jardin des Plantes, Paris (probably introduced).]

Hermosillo, Sonora, Mexico, XI, 1913, (R. S. Wolgum; in decayed orange), 1 ♀, [U. S. N. M.].

Orizaba, Vera Cruz, Mex., I, 1892, (L. Bruner), 2 ♀.

**Euborellia antoni** (Dohrn) (Plate XXVIII, figure 8.)

1864. *F[orcinella] antoni* Dohrn, Stett. Ent. Zeit., xxv, p. 289. [Venezuela.]

Atoyac, Vera Cruz, Mexico, XI, 1887, (L. Bruner), 2 juv., 1 very small juv.

Tonala, Chiapas, Mex., VII, 30, 1909, (A. Petrunkivitch; in toilet), 2 ♀, [A. M. N. H.].

The present species might easily be confused with *A. annulipes*, and the features of real differential value have been so casually stated in the literature, that it is not surprising to find that Burr has assigned this name to the synonymy under that species.

Females may be separated from those of *annulipes* by the average decidedly larger size;[2] head with margins of cheeks, behind eyes, almost straight, parallel, to the broadly rounded latero-caudal angles, thus giving the caudal portion of the head a distinctly more quadrate appearance than in *annulipes*;[3] latero-caudal angles of fifth and sixth dorsal abdominal segments sharply rounded, not broadly rounded as in *annulipes*; forceps decidedly

[2] As noted by Bormans. Das Tierreich, xi, p. 49, (1900).

[3] This feature is noted in the original description, and, though subtle, appears to be of marked diagnostic value.

heavier and shorter in proportion to the body bulk, and femora with dark markings occupying nearly their entire cephalic and caudal faces.[4]

The pale segments of the antennae are variable, in number and location, in the species of the genus; in the present series one specimen has the eleventh and twelfth on one side and the thirteenth on the other pale, the others have the fourteenth or fourteenth and base of fifteenth pale.

**Labidura bidens** (Olivier)

1791. *Forficula bidens* Olivier, Encycl. Method., Ins., vi, p. 466. [Jamaica.]

Vera Cruz, Vera Cruz, Mexico, I, 1892, (L. Bruner), 1 ♂, 1 ♀.

## Labiidae

### Spongiphorinae

**Spongiphora prolixa** Scudder

1862. *Psalidophora paralella* Dohrn (not *Forficula paralella* Westwood, 1837), Stett. Ent. Zeit., xxiii, p. 227, pl. I, figs. 3 and 3b. [Cordoba [Vera Cruz, Mexico].]

1876. *Spongiphora prolixa* Scudder, Proc. Boston Soc. Nat. Hist., xviii, p. 331. (New name for Dohrn's species.)

San Rafael, Vera Cruz, Mexico, I, 1892, (L. Bruner), 2 ♀.

It is a pleasure to record almost topotypic material of this large and striking insect, the only species of *Spongiphora*, s. s. found so far north on the North American continent.

**Spongovostox apicedentatus** (Caudell)

1905. *Spongophora apicedentata* Caudell, Proc. U. S. Nat. Mus., xxviii, p. 461, fig. 1a. [Columbia, Texas; Catalina Springs, Tucson and Fort Yuma, Arizona; Los Angeles and San Diego Counties, California.]

Aguascalientes, Aguascalientes, Mexico, (E. A. Schwartz), 1 ♂; XII, 1, 1909, (F. C. Bishopp; under *Opuntia*), 1 ♂, 1 ♀, 1 juv., [all U. S. N. M.].

**Prosparatta humilis** Hebard

1917. *Prosparatta humilis* Hebard, Trans. Am. Ent. Soc., xliii, p. 308, fig. 1, pl. XXVI, figs. 1 and 2. [Cabima, Panama; Lion Hill and Paraiso, Canal Zone, Panama.]

State of Colima, Mexico, (L. Conradt), 1 ♂, [U. S. N. M.].

This species closely resembles a depauperate condition of *Vostox brunneipennis*. The smaller eyes, not as long as the

[4] Noted in the original description and by Bormans in Das Tierreich.

cheeks, and shorter caudal metatarsus, not as long as the third caudal tarsal joint, readily separates this species.

The present specimen has the head slightly shorter and the pygidium distinctly more broadly truncate at its apex, than in the males of the type series. These differences do not, in our opinion, warrant racial or other separation. Other species of the Spongiphorinae often show much greater individual variation than this.

**Prosparatta flavipennula** (Rehn) (Plate XXVIII, figures 3 and 4.)

1903. *Sparatta flavipennula* Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 306. [Motzorongo, Vera Cruz, Mexico.]

Through a rather unjustifiable error Burr has mistaken a specimen from "Cayenne, Colombia" (!) as Rehn's type of this species, and, having determined that specimen as *Spongiphora insignis*, has wrongly placed *flavipennula* in the synonymy under that species.[5]

The type and a large topotypic series of both sexes now before us, shows the species to be a distinct member of the genus *Prosparatta*, differing from its nearest relative, *P. incerta* (Borelli), in the marked and extensive flange of the ventro-internal margin of the forceps in both sexes, which, in the male, is strikingly enlarged distad.[6] Further comparison with *incerta* shows the present species to be somewhat less slender, with pronotum shorter and having its lateral margins scarcely divergent caudad, in the male with pygidium much more elongate, distinctly longer than twice its greatest width, from which point the lateral margins converge to the sharply rounded apex, and with forceps lacking a submedian tooth.[7]

The present species was known only from one immature male and one adult female. We here describe an adult male.

*Topotype.*—♂; Motzorongo, Vera Cruz, Mexico. February, 1892. (L. Bruner.) [Hebard Collection.]

Agrees with the originally described female, here selected as single type, except in the following characters. Disto-dorsal abdominal segment with length over half its width, lateral margins very feebly convergent caudad,

[5] Proc. U. S. Nat. Mus., xxxviii, p. 457, (1911).

[6] This distinctive feature shows no variation whatever in the large series before us.

[7] In males of *incerta*, the pygidium is scarcely longer than wide, with narrow apex abruptly truncate, and the forceps bear a well developed submedian tooth.

distal margin transverse, thickened, very feebly concave laterad and broadly mesad. Pygidium, in very brief proximal portion, deplanate, other portions transversely convex; length slightly more than twice the greatest width, lateral margins very feebly convex divergent to slightly beyond median point, there with a minute rounded projection, beyond distinctly narrower, with lateral margins convergent to the sharply rounded apex. Forceps more elongate than in female, parallel to distal curvature and bearing to that point on ventro-internal margin a slight flange, with its margin subserrate to its distal portion, where it is weakly but conspicuously and broadly widened, with its margin there smooth and convex. Disto-ventral abdominal segment with length fully half its width, broadly rounded disto-laterad, with distal margin very feebly concave and supplied with a thick fringe of very short hairs.

*Measurements (in millimeters) of extremes*

| | | | Length of body | Length of pronotum | Width of pronotum | Length of forceps |
|---|---|---|---|---|---|---|
| ♂ | Motzorongo. | (14) | 6.8–9.3 | 1.6–1.7 | 1.3–1.35 | 2.7–3.7 |
| ♀ | Motzorongo. | (14) | 7.2–10 | 1.6–1.75 | 1.3–1.4 | 2.3–2.8 |

The series averages nearer the maximum.

*Specimens Examined*: 39; 14 males, 14 females, 11 immature examples.

Vera Cruz, Vera Cruz, Mexico, I, 1892, (L. Bruner), 1 juv.

Motzorongo, V. C., Mex., I, 1892, (L. Bruner), 14 ♂, 14 ♀, 10 juv.

## MICROVOSTOX Hebard

1917. *Microvostox* Hebard, Trans. Am. Ent. Soc., xliii, p. 310.

We would note that the form of the distal antennal joints is one of the most striking features for separating the species of the present genus from those of the Labiinae. These joints in *Microvostox* are elongate, cylindrical, their diameter being the same through almost their entire length. The eyes are incorrectly given in the original description as being appreciably shorter than the cheeks. In some of the species the eyes when seen in dorsal aspect would appear slightly shorter than the cheeks, but when viewed from the side their actual length is found to be fully as great as, or appreciably greater than, that of the cheeks. The length of the caudal metatarsus ranges in the species of the genus from as long as, to appreciably longer than, the combined length of the succeeding tarsal joints; no individual variation in this feature is noted, the differences being of specific diagnostic value.

We would assign the following species to *Microvostox*, in linear arrangement as given below. Those marked with an asterisk are represented in the collections before us.

**basalis* (Burr)
*recurrens* (Burr)
*vicinus* (Burr)
*confusus* (Borelli)
**alter* (Burr) genotype
**bilineatus*
*parvus* (Burr)
*ghilianii* (Dohrn)
**pygmaeus* (Dohrn)
**septentrionalis* new species
**schwarzi* (Caudell)

It would appear probable that *Labia mexicana* Bormans is a species related to *Labia barberi* Hebard; these species and those of the Championi Group of the genus *Labia* show close similarity in size and color pattern to many of the species of *Microvostox*. We feel unable to assign *Labia tricolor* Kirby.

**Microvostox basalis** (Burr)

1912. *Spongovostox basalis* Burr. Ann. k.-k. Nathist. Hofmus. Wien, xxvi, p. 337, fig. 16. ["El Zumbador" = El Tumbador, San Marcos, Guatemala.]

Orizaba, Vera Cruz, Mexico, I, 1892, (L. Bruner), 1 ♀; III, 13, 1908, (F. Knab), 1 ♀, [U. S. N. M.].

Cordoba, Vera Cruz, Mex., III, 24, 1908, (F. Knab), 1 ♀.

Females of this species and of *M. bilineatus* are very similar; a comparison has been made recently.[8]

**Microvostox septentrionalis** new species (Text fig. 1.)

1914. *Spongovostox ghilianii ?* Burr (not *Labia ghilianii* Dohrn, 1864), Can. Ent. xlvi, p. 275. (In part.) [Material here considered.]

Closely related to *M. schwarzi* (Caudell), differing in the larger size and more elongate form. In the male the pygidium is of the same general type but is more elongate, with apex minutely bilobate, and forceps, which are much longer, with a small but distinct and broad tooth on the ventro-internal margin, just beyond the mesal portion of the pygidium and a smaller tooth on the same margin one-third the distance from base to apex of the shaft. In females the forceps are proportionately slightly more slender and elongate and differ in showing a moderate, irregularly toothed dorso-internal projection. Both of these species are strikingly less robust than *M. basalis* (Burr) or *M. bilineatus* (Scudder).

*Type.*—♂; Tampico, Tamaulipas, Mexico. July, 1912. (E. A. Schwarz.) [United States National Museum.]

[8] See Hebard, Proc. Acad. Nat. Sci., 1917, p. 238, (1917). Females of both species have been recorded by Burr as *Vostox similis*, Can. Ent., xlvi, p. 275, (1914).

Size small, medium for the genus, form decidedly slender. Antennae as typical for genus. Head small; eye, when seen from side, with greatest diameter one-third greater than length of cheek; occiput showing a very feeble tendency toward bilobation, its caudal outline very feebly emarginate. Pronotum slightly longer than greatest width, lateral margins straight and very feebly divergent to the broadly convex latero-caudal angles, caudal margin weakly convex. Tegmina and wings fully developed. Dorsal abdominal segments with scent glands of third very weak, of fourth moderately prominent. Pygidium twice as long as wide, moderately declivent and with surface convex proximo-laterad, in distal portion nearly horizontal, weakly convex, lateral margins almost straight, subparallel and supplied with microscopic teeth in proximal half, weakly convex convergent and cingulate in distal half to the apex, which is minutely emarginate with lateral projecting portions sharply rounded; dorsal surface of pygidium supplied with a few scattered microscopic nodes. Forceps with shaft slender, curving very weakly and evenly, with distal portion rounded in section and tapering to the acute apex; proximal portion with inner face deplanate, its dorsal margin rounded and showing a few microscopic denticulations beyond the pygidial apex, its ventro-internal margin slightly lamellate, particularly proximad, showing microscopic denticulations, produced in a small but distinct and broad tooth just beyond the mesal portion of the pygidium, and a smaller tooth one-third the distance from base to apex of the shaft. Caudal metatarsus slightly longer than combined length of succeeding tarsal joints, ventral surface well supplied with stiff hairs.

FIG. 1.

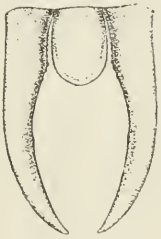

FIG. 2.

Fig. 1. *Microvostox septentrionalis* new species. Dorsal view of pygidium and forceps of male. *Type*. (X 18)

Fig. 2. *Microvostox schwarzi* (Caudell). Dorsal view of pygidium and forceps of male. Motzorongo, Vera Cruz, Mexico. (X 18).

*Allotype*.— ♀ ; same data as type. [United States National Museum.]

Size moderately larger, form and ambisexual features with proportions as described for male. Tegmina and wings fully developed. Pygidium concealed between bases of forceps. Forceps briefly separated, slightly heavier

and decidedly shorter than in male; shaft straight and weakly tapering to near apex, where it is weakly incurved, strongly tapering and slightly flattened in cross section, proximal portion subtriquetrous, ventro-internal margin weakly lamellate and roughly and irregularly denticulate, this moderately so in proximal portion of mesal third, the dorso-internal margin showing a brief, weak, irregularly projecting proximal flange which terminates caudad in an irregular blunt tooth, this margin beyond showing a few blunt denticulations.

*Measurements (in millimeters)*

| | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| ♂, *type* | 5.4 | .9 | .85 | 1.65 | 2.3 |
| ♀, *allotype* | 6.6 | .95 | .85 | 1.7 | 1.7 |

The allotype is somewhat pressed out, the length measurement being, in consequence, greater than if the specimen were in normal position.

General coloration shining blackish brown, the brown more decided on tegmina, distal portion of abdomen and on forceps. Tegmina with an elongate streak of buffy on each shoulder, extending one-half the distance to the apex. Wings with exposed surface buffy, suffused with dark brown rather broadly along sutural margin, very narrowly along costal margin.

The species is known from the described pair.

**Microvostox schwarzi** (Caudell) (Text fig. 2.)

1907. *Labia schwarzi* Caudell, Proc. U. S. Nat. Mus., xxxiii, p. 173. [Cacao, Trece Aguas, Guatemala.]

Motzorongo, Vera Cruz, Mexico, II, 1892, (L. Bruner), 5 ♂, 6 ♀, 2 juv.

These specimens show little variation and agree fully with the typical series which is before us, and from which we select a male example as single type.

LABIINAE

**Labia nodifer** Hebard

1917. *Labia nodifer* Hebard, Proc. Acad. Nat. Sci. Phila., 1917, p. 240, pl. XVI, fig. 5. [Cacao, Trece Aguas, Alta Vera Paz, Guatemala.]

Fortin, Vera Cruz, Mexico, XI, 1887, (L. Bruner), 1 ♀.

Cordoba, Vera Cruz, Mex., III, 1908, (F. Knab; in bromeliads), 1 ♂, [U. S. N. M.].

These specimens were measured and listed at the time the species was described.

**Labia rotundata** Scudder

1876. *Labia rotundata* Scudder, Proc. Bost. Soc. Nat. Hist. xviii, p. 257. [Mexico.]

1903. *Labia flaviscuta* Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 305. [Orizaba, Vera Cruz, Mexico.]

We have examined the type of *flaviscuta* Rehn and are able in consequence to place that name in the synonymy under *rotundata*. The type of *flaviscuta*, a female, is small and of pale coloration with colors well preserved. The pronotum and limbs are yellowish, the former with the dark brown of the tegmina showing through caudad, this giving the pronotum a bicolored appearance. The type of *rotundata* before us shows these features, but to a much less conspicuous degree, the colors having been less well preserved in drying.

An additional female from Orizaba, Vera Cruz, Mexico, and an unlabelled pair of this species from the National Museum have been examined and compared with other species of the genus.[9]

The pygidium of the female type of *rotundata* has recently been figured.[10]

**Labia dorsalis** (Burmeister)

1838. *F*[*orficula*] *dorsalis* Burmeister, Handb. Ent., ii, ii abth., pt. i, p. 754. [Colombia.]

Motzorongo, Vera Cruz, Mexico, II, 1892, (L. Bruner), 2 ♂.

Cordoba, Vera Cruz, Mex., XII, 6, (F. Knab), 1 ♂, [U.S.N.M.].

This species, which has usually appeared in the literature as the synonymous *L. chalybea* of Dohrn, has been recently fully considered, as noted under *L. rotundata*. It is clearly not a synonym of *L. annulata*, under which species Burr assigned, at the same time, *arcuata*, *dorsalis* and other names.

**Prolabia arachidis** (Yersin)

1860. *Forficula arachidis* Yersin, Ann. Soc. Ent. France, (3), viii, p. 509, pl. X, figs. 33 to 35. [ [Adventive at] Marseilles, France.]

Vera Cruz, Vera Cruz, Mexico, (T. Heyde), 1 ♀.

Individuals of this species are usually very greasy and thoroughly unpleasant.

**Prolabia triquetra**[11] new species (Plate XXVIII, figures 5, 6 and 7.)

This species is closely related and very similar in general appearance to *P. arachidis*, differing greatly in the character of the forceps in both sexes. The adults before us, with one exception, show fully developed wings.

[9] See Hebard, Trans. Am. Ent. Soc., xliii, p. 317, (1917).

[10] Proc. Acad. Nat. Sci. Phila., 1917, pl. XVI, fig. 7.

[11] In allusion to the forceps, which are conspicuously triquetrous in both sexes.

*Type.*—♂; Orizaba, Vera Cruz, Mexico February 20, 1892. (L. Bruner.) [Hebard Collection Type No. 435.]

Size rather small, form moderately stout, but not as stout as in *arachidis*. Head as in that species, moderately convex with sutures obsolete; distal antennal joints not as elongate as in *arachidis*, longest about three times as long as greatest, meso-distal, width.[12] Antennae with twelve to thirteen joints,[13] one or two of the distal joints being pale. Pronotum subquadrate, caudal margin weakly convex-truncate;[14] prozona rather decidedly convex proximad with brief but distinct, convex, meso-lateral sulci which converge caudad, weakly convex meso-caudad; metazona deplanate, with lateral margins feebly raised; the pronotum shows a feeble, medio-longitudinal, linear sulcus which is strongest cephalad. Tegmina nearly twice as long as pronotum, truncate distad; wings extending beyond tegmina about two-thirds the pronotal length, narrowly truncate distad. Abdomen showing more hairs than in *arachidis*; second and third dorsal segments feebly and roundly keeled laterad, seventh and eighth dorsal segments with disto-lateral angles very broadly rounded, disto-dorsal segment simple, as in *arachidis*, showing a very feeble convex projection above each arm of the forceps. Pygidium, as in *arachidis*, subquadrate, slightly longer than wide, with disto-lateral portions briefly cut off obliquely and distal margin transverse, weakly concave. Forceps triquetrous, dorsal and ventral surfaces deplanate, hairy; inner surface deplanate between the distinctly raised margins at the juncture with the dorsal and ventral surfaces, dorsal margin smooth, ventral margin with a minute offset tooth at the disto-lateral portion of the pygidium and with a minute tooth at twice this distance from the base of the forceps.[15] Penultimate ventral abdominal segment hairy, nearly three times as broad as long, with distal margin broadly convex and showing a feeble mesal concavity.

*Allotype.*— ♀; same data as type. [Hebard Collection.]

Agrees with type except in the following characters. Size slightly larger, form slightly more robust than in male, not as stout as in this sex of *arachidis*. Disto-dorsal abdominal segment over twice as broad as long, distinctly narrower caudad than cephalad, weakly concave meso-distad, caudal margin truncate. Pygidium declivent, small, rectangular, disto-ventral portion inset between the forceps, its ventral surface in the same plane with ventral surface

[12] In *arachidis* fully four times as long as the greatest width, which is found at the apex.

[13] In the type the antennae are incomplete. These features are, in consequence, determined from the series.

[14] In the female before us lacking wings, the pronotum is as typical in *arachidis*, with caudal margin very weakly convex-truncate, in mesal portion almost perfectly transverse. This difference may very probably be found to accompany reduction in the organs of flight, a condition which has been found to occur almost universally in the Blattidae.

[15] In the type this second tooth is missing on the dextral arm, in the paratypic male it is present on both arms.

of forceps and its narrow distal margin transverse, with disto-lateral angles produced in acute-angulate, but rounded, minute projections.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|
| Orizaba. *Type.* | 6.5 | 1.15 | 1.2 | 1.9 | 2.6 |
| Minatitlan. *Paratype.* | 6 | 1.15 | 1.2 | 2 | 3 |
| ♀ | | | | | |
| Orizaba. *Allotype.* | 8 | 1.2 | 1.3 | 2.1 | 2.1 |
| Orizaba. *Paratypes.* | 6–8 | 1.2–1.3 | 1.2–1.35 | 1.4–1.9 | 1.7–2.1 |
| Chalchicomula. *Paratype.* | 8 | 1.2 | 1.3 | 2.3 | 2.2 |

*Coloration.* Male. (*Type.*) Head blackish chestnut brown; antennae prouts brown, one or two of the distal joints pale (in series). Pronotum, tegmina and wings cinnamon brown. Abdomen chestnut, suffused proximo-laterad with blackish chestnut brown. Forceps chestnut. Limbs dresden brown above, paler below. The male paratype and the females before us are more unicolorous, chestnut in general coloration with proximo-lateral abdominal suffusion obsolete. A marked recession and intensification is shown by the series, the small wingless female from Orizaba being the darkest of all.

*Specimens Examined*: 8; 2 males, 5 females, 1 immature example.

Orizaba, Vera Cruz, Mexico, I, 9 to 16, 1892, (H. Osborn), 1 ♀[16] *paratype*, [U. S. N. M.]; II, 20, 1892, (L. Bruner), 1 ♂, 3 ♀, *type*, *allotype* and *paratypes*, 1 juv.

Minatitlan, Vera Cruz, Mex., II, 1892, (L. Bruner), 1 ♂, *paratype*.

Chalchicomula, Puebla, Mexico, (L. Bruner), 1 ♀, *paratype*.

SPARATTINAE

**Sparatta w-signata** Burr (Plate XXVIII, figure 9.)

1904. *Sparatta w-signata* Burr, Trans. Ent. Soc. London, 1904, p. 302. [Mexico.]

Motzorongo, Vera Cruz, Mexico, II, 1892, (L. Bruner), 2 ♂, 6 ♀.

This series shows little structural or color variation. The tegmina and wings are black with a metallic bluish luster, this distinctly less vivid than in *S. biolleyi* or *S. pulchra*. The disto-dorsal abdominal segment, in both sexes, shows the impressed W, with bases not reaching the caudal margin of the segment and broadly rounded.

The male pygidium is perpendicular, with surface convex, its length equalling its distal width, the distal margin transverse, cingulate, terminating on each side in a minute, rounded knob. The male forceps show the proximal triquetrous portion to have

[16] Recorded by Rehn in 1903 as *Labia guttata*, and by Burr in 1910, with a question, as *Labia unidentata*.

its dorsal margin crenulate in one, very feebly so in the other specimen; in both, the ventro-internal margins of this portion are rather minutely denticulate than crenate as originally described, with a single stout, distal tooth, this tooth, however, smaller than the median tooth. The dilation beyond the median tooth is acute-angulate distad rather than toothed.

The female has the pygidium longer than broad, with lateral margins strongly concave, convergent, then divergent for a shorter distance to the acute-angulate, disto-lateral angles, the distal margin briefly acute-angulate produced to a less degree, with apex of the production blunt. The female forceps are nearly straight, with ventral margin produced in a moderate flange to the arcuate distal portion, this flange showing rather widely spaced, blunted teeth to just beyond the mesal portion, where it is weakly angulate produced, from this point distad the flange is narrower, with margin smooth, to its weakly convex termination.

*Measurements (in millimeters)*

| | | | Length of body | Length of pronotum | Length of tegmen | Length of forceps |
|---|---|---|---|---|---|---|
| ♂ | Motzorongo. | (2) | 10–10.7 | 1.6–1.7 | 2.8–3 | 3.8–4.1 |
| ♀ | Motzorongo. | (5) | 9.5–10.6 | 1.6–1.7 | 2.7–2.8 | 2.3–2.7 |

The only other species of the genus described from Mexico, *S. bormansi* Kirby, is described as having, in the female type, the pygidium with central part projecting rectangularly and longer than the basal part.

**Parasparatta dentifera** (Rehn) (Plate XXVIII, figures 10 and 11.)

1901. *Sparatta dentifera* Rehn, Trans. Am. Ent. Soc., xxvii, p. 218. [Orizaba, Vera Cruz, Mexico.]

1907. *Sparatta minuta* Caudell, Proc. U. S. Nat. Mus., xxxiii, p. 172. [Polochic River below mouth of Cahabon River, Guatemala.]

The types of *dentifera* and *minuta* show the unquestionable synonymy indicated above. It should be noted that Rehn mistook the female type of *dentifera* for a male and described it as such. The present series of adult males shows this species to be widely distinct from Burr's *P. armata*. It is clear that Burr, in the Genera Insectorum, indulged too freely in conjecture when he placed, with queries, *dentifera* (with other names, three of which we find to represent valid species) under *S. pelvimetra* and *minuta* under *P. armata*.

Excellent figures of this insect are given by Bormans in the Biologia, as *S. nigrina*, plate I, fig. 11 being the dorsal aspect of the male, fig. 12 showing further error by that author, as it is, in fact, an excellent outline of the ventral aspect of the pygidium and forceps of the same sex, though stated to be of the female. Borelli has pointed out this association in part, describing the male and giving further characters for the female, in addition to a full comparison with *P. nigrina* (Stål).[17] In this connection, we would remark that, in the series before us, the antennae are uniform in coloration or have the proximal joints only slightly darkened.

Never, in our experience, has a series of the same species shown more startling variation than the present. Some specimens are tremendously larger than others. The normal coloration is, head, pronotum, tegmina, wings and dorsal surface of abdomen to ultimate segment, shining blackish, the ultimate segment, pygidium and forceps shining ferruginous; often the contrast between these colors is less decided and, in one specimen, the general coloration is prouts brown, with ultimate dorsal abdominal segment, pygidium and forceps slightly paler. The male pygidium, however, shows the greatest individual differentiation, in the two larger males and one of the smaller males it has the meso-distal production rectangulate, slightly longer than wide (Plate XXVIII, figure 10), in the other smaller males it is triangular, with apex very briefly truncate, varying to acute, in length slightly greater than its proximal width. Many of the smaller males show forceps with contour variously somewhat simplified and with the three teeth on each arm reduced. In the smallest male before us the forceps have retained, in large part, the immature form; the sinistral being simple and unarmed, the dextral only weakly specialized and with only the median and distal tooth weakly developed.

This insect is clearly one of those plastic species in which features of full and fixed diagnostic specific value in other related forms, show decided individual differences.

[17] Boll. Mus. Zool. Anat. Comp. Univ. Torino, xxx, no. 699, p. 3, (1915).

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Length of tegmen | Length of forceps | Length of pygidium |
|---|---|---|---|---|---|
| Orizaba. | 8 | 1.2 | 1.6 | 3.1 | 1.1 |
| Orizaba. | 6.4 | 1.1 | 1.4 | 2.8 | .9 |
| Motzorongo. (5) | 4.5–5.2 | .8–.9 | 1.2–1.2 | 1.6–2.1 | .35–.5 |
| Motzorongo[18] | 4 | .7 | 1.2 | 1.3 | .35 |
| ♀ | | | | | |
| Orizaba, *Type.* | 7 | 1.2 | 1.7 | 2.5 | |
| Orizaba. | 5.3 | .8 | 1.2 | 1.7 | |
| Motzorongo. (4) | 5–6.2 | .8–.9 | 1.1–1.2 | 1.8–1.9 | |

It is to be noted that, with the reduction in size, the reduction in the male pygidium is greater proportionately to that in the forceps. In the largest male the pygidium is over one-third the length of the forceps, in the next largest male one-third, while in the series of small males the pygidium averages about one-quarter the length of the forceps.

*Specimens Examined:* 16;[19] 10 males and 6 females.

Orizaba, Vera Cruz, Mexico, I and II, 20, 1892, (L. Bruner), 2 ♂, 1 ♀; VI, 6, 1899, (O. W. Barrett), 1 ♀, *type*, [A. N. S. P.].

Motzorongo, Vera Cruz, Mexico, II, 1892, (L. Bruner), 8 ♂, 4 ♀.

## Forficulidae

### anechurinae

**Anechura vara** (Scudder) (Plate XXVIII, figures 12, 13 and 14.)

1876. *Forficula vara* Scudder, Proc. Bost. Soc. Nat. Hist., xviii, p. 260. [Puebla (terra frigida), Mexico.]

Chalchicomula, Puebla, Mexico, II, 1892, (L. Bruner), 26 ♂, 33 ♀.

When compared with Burr's diagnosis of the genus and material of the genotype, *A. bipunctata* (Fabricius), the present insect is found to differ in having the fifth antennal joint longer than the third; the male having the ultimate dorsal abdominal segment smooth and without projections above, but with a bluntly conical projection on each side ventrad, at the juncture with the subchitinous, bilobate subgenital plate.[20] These features may require the separation of *vara* from the genus *Anechura*, but we

[18] Forceps not fully developed, smallest and least brilliantly colored specimen.

[19] We have also examined the type of Caudell's synonymous *S. minuta*, from Guatemala.

[20] These projections are homologous to the spiniform tubercles found in *Praos perditus* (Borelli), which author described them as being on the subgenital plate.

have at present an insufficient representation of the species of the present subfamily to determine this.

In the present species the antennae have eleven (twelve, normal) to thirteen (rare) joints, the fourth being normally subequal in length to the third, but showing some individual variation. The tegmina have their sutural margins sometimes fused. The size variation is moderately decided, but the male forceps show great variation, the series before us showing every gradation between the extremes.[21] With reduction in the heaviness and irregularity of contour of the male forceps, the latero-ventral projections are correspondingly reduced. Length of body, ♂, 6.4 to 10; ♀, 6.1 to 9.5: of forceps, ♂, 2.8 to 3.2; ♀, 2.4 to 2.9 mm.

The heavier forceps are so much more curved than the more simple type, which is usually found in the smaller examples, that little difference in the actual length is found.

FORFICULINAE

**Skalistes lugubris** (Dohrn) (Plate XXVIII, figures 15 and 16.)

1862. *Forficula lugubris* Dohrn, Stett. Ent. Zeit., xxiii, p. 230. [Cordoba [Vera Cruz], Mexico.]

1903. *Forficula metrica* Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 311. [Orizaba, Vera Cruz, Mexico.].

Orizaba, Vera Cruz, Mexico, I, 13, 1892 and XI, 1887, (L. Bruner), 20 ♂, 32 ♀, 2 juv.

Chalchicomula, Puebla, Mex., II, 1892, (L. Bruner), 3 ♂, 4 ♀.

As Burr has shown, Rehn's *metrica* is based on the condition of this species in which elongate forceps are developed.

We do not believe that *S. inopinata* (Burr) and *S. cornuta* (Burr)[22] are synonymous, as that author has indicated. The proximo-internal dorsal flange of the male forceps is slightly more prominent in the specimens before us with short forceps, but no trace of a dorsal conical projection is found. In the present insect the male forceps have this flange with margin cingulate and unbroken, below it a row of denticulations are found, from above only visible proximad before the commencement of the flange. The variation in both length and degree of curvature of the male forceps is very marked in the present series.

[21] See plate XXVIII, figures 12, 13 and 14.

[22] This name was proposed for the male sex described by Bormans as *Labia chelidurοides*.

Length of body, ♂, 7.5 to 9.8; ♀, 8.7 to 9.5: of forceps, ♂, 3.8 to 8.7; ♀, 3.3 to 4.1 mm.

**Doru lineare** (Eschscholtz)

1822. *Forficula linearis* Eschscholtz, Entomogr., p. 81. [Santa Catharina, Brazil.]

The synonymy of the present species and the Mexican material represented in the present collections has been fully studied.[23]

NEOLOBOPHORINAE

**Neolobophora ruficeps** (Burmeister)

1838. *F[orficula] ruficeps* Burmeister, Handb. Ent., ii, ii abth., pt. i, p. 755. [Mexico.]

Atoyac, Vera Cruz, Mexico, XI, 1887, (L. Bruner), 1 ♂.

Fortin, Vera Cruz, Mex., XI, 1887, (L. Bruner), 4 ♂, 1 ♀, 1 juv.

Orizaba, Vera Cruz, Mex., I, 13, 1892, (L. Bruner), 5 ♂, 7 ♀.

Motzorongo, Vera Cruz, Mex., II, 1892, (L. Bruner), 2 ♂, 1 juv.

Chalchicomula, Puebla, Mex., II, 1892, (L. Bruner), 1 ♀.

Burmeister's description, though very incomplete, is sufficient to determine the species without question; Scudder's more fully described *volsella*, has been shown to be an absolute synonym.

It is of interest to note that the Mexican series before us differs in the following respects from the features considered diagnostic for *ruficeps* by Burr.[24] The tegmina and caudal portions of the pronotum are smooth in these specimens, the male pygidium with the form of its two apical projections varying from elongate trigonal (as found in the majority of the present series and in all the Costa Rican and Panamanian specimens before us), to minute, and sharply conical, these disto-lateral in position. The smoothness or roughness of the tegmina and caudal portions of the pronotum is evidently of no specific value in *ruficeps*, though it apparently has some geographic significance. In a species as variable as the present, we would strongly oppose the separation of the more southern series as a distinct geographic race. At any rate, the species was described from Mexico and, from the material at hand, we believe the typical condition to be that with smooth pronotum and tegmina.

[23] Rehn and Hebard, Jour. N. Y. Ent. Soc., xxii, p. 90, figs. 1 to 4, (1914).

[24] Ent. Monthly Mag., Ser. 2, xvii, p. 112, (1906).

We find it necessary, in consequence, to furnish a new comparison between the males of *N. ruficeps* and *N. borellii*.

| | *N. ruficeps* | *N. borellii* |
|---|---|---|
| First tarsal joint normally[25] | as long as three succeeding joints | decidedly shorter than three succeeding joints |
| Tegmina with surface | smooth or punctulate | smooth |
| In length | less abbreviate | more abbreviate |
| Pygidium with projections | triangular elongate or minute conical | blunt or absent |
| Forceps, compared with body length | shorter to longer than | shorter than |
| Both internal margins | minutely denticulate to varying degrees | smooth |
| Medio-internal, proximal tooth | minute and inconspicuous | small but striking |
| Internal margins armed | dorsad and ventrad, at middle, or just beyond, with a minute tooth | ventrad only, at two-thirds distance to apex, with a rather heavy tooth |
| Shaft | nearly straight | upcurved at distal tooth |
| First tarsal joint of caudal limbs | scarcely longer than second and third | decidedly longer than second and third |

In the present series the distal, darkened portions of the femora are striking, except in some specimens in which the limbs are entirely darkened. The face is darkened, but only in a few specimens sharply and strikingly delimited from the paler occipital portions, which is the normal condition in the Costa Rican and Panamanian series.

**Neolobophora borellii** Burr

1906. *Neolobophora borellii* Burr, Ent. Monthly Mag., Ser. 2, xvii, p. 113. [Near Guadalajara, Jalisco, Mexico.]

Sonora, Mexico, (C. Lumholtz), 3 ♂, 3 ♀, [A. M. N. H.].

This species is compared with *N. ruficeps* above, the characters for *borelli* being taken from Burr's original description and from the present series. The series before us differs from Burr's description in pronotal coloration and contour of male pygidium. These features, we believe, show only variation, in some ways analogous to the variation found in *ruficeps*, not worthy of specific or racial distinction.

[25] In rare specimens, evident distortion of the antennal joints is found on one, or both, sides; in one example of *borellii*, the second, third and fourth joints are greatly dwarfed.

In the present material the third and fourth dorsal abdominal segments have well developed, brief, rounded, lateral carinae (the stink-glands), those of the fourth segment being the larger. The male pygidium is declivent, slightly longer than broad, with narrow proximal portion concave and large distal portion convex in contour, nearly circular in outline, without trace of disto-lateral projections. The caudal limbs have the first tarsal joint decidedly longer than the combined length of the second and third joints.

These specimens have the head, antennae, limbs, greater portion of pronotum and the tegmina along the humeral angle, cinnamon rufous. The large meso-caudal portion of the pronotum, remaining area of tegmina, the abdomen and forceps are chestnut brown.

### ANCISTROGASTRINAE

The forms of this group are varied and striking, the specialization of the male dorsal abdominal segments being in many species remarkable.

We are forced to change the generic association of a number of species, the evidently wrong assignments being mainly due to the separation of genera upon the but rarely valid character of presence or absence of fully developed wings. Had we material for comparison of all the species involved, the task would be less difficult. The presence in the collections before us, of the species *perditus*, genotype of Burr's *Praos*, and *championi*, genotype of Burr's *Vlax*, enables us to reach definite and important conclusions. The descriptions are exceptionally adequate and numerous figures are given of the other species with which we are concerned. The results may be summed up as follows.

The structure of *championi*, genotype of *Vlax*, shows much closer similarity to that of *perditus*, genotype of *Praos*, than to any of the other species assigned to *Vlax*;[26] this is also true for *perditus*, when compared with *impennis*, assigned by Burr with a query to *Praos*.[27] Indeed no sufficiently important features

[26] It is evident that Burr drew up his original description of *Vlax* from *tolteca* of Scudder, though he chose *championi* of Bormans as the genotype.

[27] The features compelling this assignment have been discussed in a paper on Panamanian Orthoptera, the species involved being in no way associated with the Mexican fauna. We would note that recently Borelli has described a species as *Praos uncinatus*, this insect being clearly a member of the genus *Ancistrogaster*. That author has very kindly sent us a figure of the forceps, drawn from the type of this species.

occur to warrant the generic separation of the species *perditus* and *championi* and, in consequence, *Vlax* must fall as a synonym of *Praos*, which name has page priority. The genus *Praos* resultantly is found to include one species with, and one without, fully developed wings. Proceeding further, from the material of *tolteca* before us (assigned by Burr to *Vlax*),[28] of *gulosa* (originally referred to *Ancistrogaster*), and the excellent description and figures of *impennis* (assigned by Burr with a query to *Praos*), *silvestrii* and *dugesi* (assigned by Borelli and Burr to *Paracosmia*, of which *silvestrii* is the genotype), it is clear that these species are congeneric, *tolteca* and *gulosa* having fully developed wings. As a result, the known Mexican species of the Ancistrogastrinae are all referable to *Paracosmia*, with the exception of *Ancistrogaster spinax* and *uncinatus*.

**PARACOSMIA** Borelli

1909. *Paracosmia* Borelli, Boll. Lab. Zool. Scuola Agr. Portici, iii, p. 323.

The following modifications of the original description are made. Wings concealed or fully developed. Abdomen of male more or less dilated mesad or meso-distad, dorsal surface weakly convex; stink gland of third segment small, of fourth segment large; fifth, or fifth, sixth and seventh dorsal segments weakly angulato-produced dorso-laterad, in decreasing ratio caudad and there feebly keeled. Dorsal surface of female abdomen with stink glands, but without dorso-lateral production. Disto-dorsal abdominal segment of male with sides straight or angulato-emarginate, dorsal surface little specialized in contour, margins ventrad on each side, at juncture with subgenital plate, produced in two minute, angulate projections, with apices blunt. Male forceps variously armed.[29]

**Paracosmia tolteca** (Scudder) (Plate XXVIII, figures 17, 18 and 19.)

1876. *Forficula tolteca* Scudder, Proc. Bost. Soc. Nat. Hist., xviii, p. 261. [Mexico.]

[28] Two other species, *intermedius* and *festae*, were assigned to *Vlax* by Burr. These are both South American, and would appear to represent a genus, or genera, not found in the Central American fauna.

[29] As given by Borelli for the genus, the caudal metatarsus is equal to the combined length of the second and third joints in *P. gulosa*, but in *P. tolteca* it is distinctly more elongate than that measurement. We do not feel that sufficient difference is, however, shown by *tolteca* to warrant generic separation.

Orizaba, Vera Cruz, Mexico, I, 9 to 16, 1892 and XI, 1887, (Bruner; Osborn), 43 ♂,[30] 80 ♀, 21 juv.

Cordoba, Vera Cruz, Mex., XII, 6, (F. Knab), 1 ♂, [U.S.N.M.].

The male forceps are found to vary from very weakly to strongly bowed: in the former type the heavy ventro-internal tooth is situated mesad or meso-proximad; in the latter this tooth is situated distad or meso-distad. The extremes, and an almost intermediate condition, are about equally represented in the series, the majority of intermediates have the ventro-internal tooth distad or meso-distad. The dissimilarity in general appearance, caused by this feature, is very great. In all the adults before us, the wings are fully developed, in some of the females being somewhat shortened, with exposed portion shorter than the length of the pronotum.

In this series the general coloration varies from cinnamon brown to almost black. The exposed portions of the tegmina are immaculate, or have a small, buffy proximal area, this varying individually in extent, but usually very small.

**Paracosmia gulosa** (Scudder)

1876. *Ancistrogaster gulosa* Scudder, Proc. Bost. Soc. Nat. Hist., xviii, p. 259. [Puebla (terra frigida), Mexico.]

Through the kindness of Dr. Samuel Henshaw, we have before us four males and one female, cotypes, of which we select a large male as the single type, the female as the allotype. These specimens were taken by Sumichrast, in the month of January.

The species is closely related to the genotype, *silvestrii*, differing mainly in the presence of fully developed wings. It is possible that large series will show that in this group individuals of the same species may have fully developed, reduced or absent wings, in which case *silvestrii* will probably be found a synonym of *gulosa*.

The proportionately much larger pronotum, which is much wider than the dorsal width of one of the tegmina, readily distinguishes individuals of both sexes from those of the Mexican species, *Ancistrogaster spinax* and *A. uncinatus*.

[30] Rehn, in 1903, recorded males with forceps slightly bowed as *Ancistrogaster tolteca*, those with forceps strongly bowed as *Ancistrogaster gulosa*.

*Measurements (in millimeters)*

| ♂ | Length of body | Length of pronotum | Width of pronotum | Length of tegmen | Exposed length of wing | Length of forceps |
|---|---|---|---|---|---|---|
| *Type.* | 12.8 | 1.8 | 1.9 | 3.6 | 1.6 | 4.4 |
| *Paratype.* | 10.2 | 1.7 | 1.9 | 3.2 | 1.3 | 3.8 |
| ♀ | | | | | | |
| *Allotype.* | 11 | 1.9 | 2.1 | 3.4 | 1.7 | 3.3 |

The small series before us shows that the same type of variation in the male forceps is developed in *P. tolteca* and *gulosa*. The two largest males have strongly bowed forceps; these specimens are heavier than the other two males and have the disto-lateral angles of the fourth to sixth dorsal abdominal segments more sharply produced. The smallest male paratype is measured above.

**Ancistrogaster spinax** Dohrn

1862. *Ancistrogaster spinax* Dohrn, Stett. Ent. Zeit., xxiii, p. 229, pl. I, fig. 1. [No locality given.]

Jalapa, Vera Cruz, Mexico, VIII and IX, (O. W. Barrett), 1 ♂, 5 ♀, [A. N. S. P. and Hebard Cln.].

Teocelo, Vera Cruz, Mex., IX, (O. W. Barrett), 3 ♂, 1 ♀, [A. N. S. P.].

These specimens have been previously recorded by Rehn, in part correctly, in part as *A. luctuosus*.

**Ancistrogaster uncinatus** (Borelli)

1915. *Praos uncinatus* Borelli, Boll. Mus. Zool. Anat. Comp. Univ. Torino, xxx, no. 699, p. 3. [Jalapa, Mexico.]

Cordoba, Vera Cruz, Mexico, I, 27 to II, 10, 1908 (F. Knab), 1 ♂, 2 ♀,[31] [U. S. N. M.].

Presence or absence of wings or of an internal proximal tooth of the forceps is of no generic significance in the present subfamily.[32] The present insect does not agree with the general structural development in the genus *Praos*, but shows a structural development characteristic of species of the genus *Ancistrogaster*.

The specimens before us all have fully developed wings, which organs are absent in the type of *uncinatus*, which is smaller than

[31] This probably represents the material recorded by Burr as *A. variegata*, Can. Ent., xlvi, p. 276, (1914).

[32] See Hebard, Trans. Amer. Ent. Soc., xliii, p. 330, (1917).

the male before us, and does not have two minute, internal, slender, rounded projections on each branch of the forceps, one ventrad at the pygidium, the other dorsad a distance caudad equal to the pygidial width, as in this specimen. In other respects the material before us is typical. We do not believe that presence or absence of wings, or such differences from the type as shown by the male at hand, will be found of specific diagnostic value in this or other species of the present group.

The remarkably produced and decurved fifth to seventh dorsal segments of the male abdomen are a striking feature in males of this species. The pronotum differs from that of *A. spinax* in having the latero-caudal angles indicated, the margin from the latero-cephalic angles not being evenly convex as in *spinax*. This is one of the best features to separate females of *uncinatus* and *spinax*, which are very similar in general appearance.

## Explanation of Plate XXVIII

The figures, unless otherwise specified, are all greatly enlarged.

Fig. 1.—*Pyragra fuscata* Serville. Dorsal view of apex of male abdomen and forceps, normal condition. Fortin, Vera Cruz, Mexico. (× 2.4)

Fig. 2.—*Pyragra fuscata* Serville. Dorsal view of apex of male abdomen and forceps, showing very unusual differentiation. San Rafael, Vera Cruz, Mexico. (× 2.4)

Fig. 3.—*Prosparatta flavipennula* (Rehn). Dorsal view of male pygidium. Motzorongo, Vera Cruz, Mexico. *Topotype.*

Fig. 4.—*Prosparatta flavipennula* (Rehn). Dorsal view of apex of male abdomen and forceps. Motzorongo, Vera Cruz, Mexico. *Topotype.* (× 6.4)

Fig. 5.—*Prolabia triquetra* new species. Outline of female antenna. Orizaba, Vera Cruz, Mexico. *Allotype.*

Fig. 6.—*Prolabia triquetra* new species. Dorsal view of sinistral arm of male forceps. Orizaba, Vera Cruz, Mexico. *Type.* (× 9.2)

Fig. 7.—*Prolabia triquetra* new species. Dorsal view of apex of female abdomen and forceps. Orizaba, Vera Cruz, Mexico. *Allotype.* (× 6.5)

Fig. 8.—*Euborellia antoni* (Dohrn). Lateral view of apex of female abdomen and forceps. Tonala, Chiapas, Mexico. (× 2.1)

Fig. 9.—*Sparatta w-signata* Burr. Dorsal view of apex of male abdomen and forceps. Motzorongo, Vera Cruz, Mexico. (× 4)

Fig. 10.—*Parasparatta dentifera* (Rehn). Dorsal view of apex of male abdomen and forceps, showing highest specialization. Orizaba, Vera Cruz, Mexico. *Topotype.* (× 4.4)

Fig. 11.—*Parasparatta dentifera* (Rehn). Dorsal view of apex of female abdomen and forceps. Orizaba, Vera Cruz, Mexico. *Topotype.* (× 5.3)

Fig. 12.—*Anechura vara* (Scudder). Lateral outline and dorsal view of male forceps, showing highest specialization. Chalchicomula, Puebla, Mexico. (× 5.8)

Fig. 13.—*Anechura vara* (Scudder). Lateral outline and dorsal view of male forceps, showing moderate specialization. Chalchicomula, Puebla, Mexico. (× 4)

Fig. 14.—*Anechura vara* (Scudder). Lateral outline and dorsal view of male forceps, showing least specialization. Chalchicomula, Puebla, Mexico. (× 4.5)

Fig. 15.—*Skalistes lugubris* (Dohrn). Dorsal view of male forceps, showing highest specialization. Orizaba, Vera Cruz, Mexico. (× 3.7)

Fig. 16.—*Skalistes lugubris* (Dohrn). Dorsal view of male forceps, showing least specialization. Orizaba, Vera Cruz, Mexico. (× 3.3)

Fig. 17.—*Paracosmia tolteca* (Scudder). Dorsal view of male forceps, showing highest specialization. Orizaba, Vera Cruz, Mexico. (× 4)

Fig. 18.—*Paracosmia tolteca* (Scudder). Dorsal view of male forceps, showing moderate specialization. Orizaba, Vera Cruz, Mexico. (× 3.7)

Fig. 19.—*Paracosmia tolteca* (Scudder). Dorsal view of male forceps, showing least specialization. Orizaba, Vera Cruz, Mexico. (× 3.8)

# STUDIES OF NORTH AMERICAN PLECOPTERA (PTERONARCINAE AND PERLODINI)

BY LUCY WRIGHT SMITH

## *Introduction*

Plecoptera, or stone-flies, are of universal distribution; they are found on all the continents and in all climates from the arctic region to the tropics. For the most part the adults are dark brown, inconspicuous insects with elongate, depressed bodies, long, slender antennae and setae, and two pairs of membranous wings which lie folded over the body in a horizontal position when the insects are at rest. In general, stone-flies are poor fliers and can be found crawling around the stones, on banks of streams or on nearby trees much oftener than on the wing. Ordinarily they are not seen in great numbers on account of their more or less protective coloration and their habit of crawling away into hiding in cracks and crevices. The immature form, the nymphs, are found much more abundantly. These can be seen in almost any stream, on the under side of stones, or hidden away in masses of drifted leaves. Aside from the absence of wings, they are much like the adults in form. The majority of them possess tracheal gills, situated usually on the ventral side of the thorax, but they may occur on the under side of the head, on the basal abdominal segments, or at the tip of the abdomen.

Despite the wide distribution of stone-flies and their comparative abundance, a large collection of them is rarely found in the possession of institutions or individuals. Likewise, the amount of work, that has been done on the order, is very small. A few systematists have been interested in them and have described a good many, but aside from that they are little known. Only occasionally has some biological or morphological aspect of a genus or species attracted anyone's attention.

My own interest in the group is primarily ecological, and my first two years' study of it was of that nature. During that time many life-histories were obtained, and considerable interesting data were accumulated on such things as emergence, feeding

habits, egg-laying and mating. In attempting the identification of the material upon which I was working, a great lack of detailed systematic knowledge was keenly felt. In many instances original descriptions are inadequate both on account of their brevity and also because of the characters chosen for the basis of the descriptions. Coloration, which is exceedingly variable in the group, has often served as the chief character. Venation has been used also, but here again the inconstancy of certain characters that were selected, such as the number of tips of veins or the number of cross-veins, makes them of little value. The need for a more complete systematic working basis seemed so great that, at Prof. Needham's suggestion, the ecological work was put aside temporarily, and such a study commenced.

Prof. Franz Klapálek (Prague, Bohemia), who has done perhaps more than anyone else on the group in recent years, has used with considerable success genital and venational characters as the basis for his descriptions. In my own work on the North American forms I am also making them the essential characters in my descriptions. The genitalia of this order are not only constant in form for each species, and, therefore good characters, but they are so diverse, and, in many instances, so remarkable, that they are unusually distinctive. Although stone-flies are very primitive in many ways they have reached a high degree of specialization in this respect. Quite apart from their value systematically, the genitalia are intensely interesting, on account of their complexity, from morphological and physiological viewpoints.

In the order Plecoptera I recognize a single family and four sub-families:

Perlidae
- Pteronarcinae
- Perlinae
- Nemourinae
- Capninae

The present study, which is only a beginning of a monograph of the order, treats the Pteronarcinae and a portion of the Perlinae under the tribal name Perlodini. This sub-family and tribe can be distinguished from all other Plecoptera on the presence of an apical network of supernumerary cross-veins. In the Pteronarcinae the network extends in the fore-wing from costa through the anal veins. In the Perlodini it is of greater or less extent but

is restricted to the anterior part of the wing, never extending in the fore-wing posterior to the cubital veins. In the genus *Acroneuria* the network is more sub-apical and is confined to the region between cubitus, and the posterior branches of the radial sector.

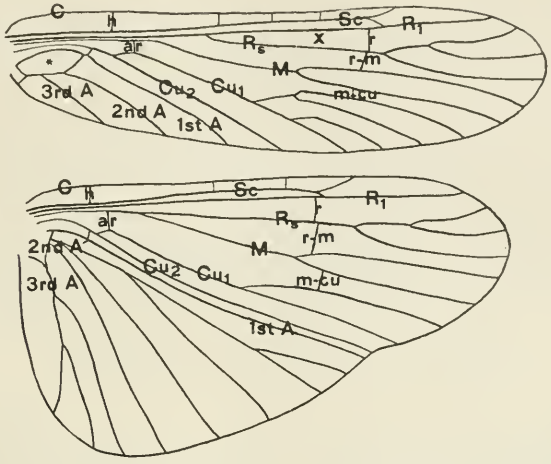


FIGURE A.—Diagram of Plecoptera Venation.

In the venation of the Plecoptera (fig. A) we recognize in both wings the following longitudinal veins; C = costa; Sc = sub-costa; R = radius composed of $R_1$ = radius$_1$ and Rs = radial sector; M = media; Cu = cubitus, composed of $Cu_1$ = cubitus$_1$, and $Cu_2$ = cubitus$_2$; 1st A = first anal vein; 2nd A = second anal vein; 3rd A = third anal vein. A few cross-veins recur constantly; they are, h = humeral; r = radial; ar = arculus; r-m = radio-medial; m-cu = medio-cubital. Two cells of the fore-wing, x = inner inter-radial cell, and the anal cell, designated by an asterisk in the diagram, furnish additional venation characters.

An extensive examination of material has been made possible in this study through the kindness of a number of institutions which have loaned us their Plecoptera collections. I wish to thank most heartily the Museum of Comparative Zoology, the Academy of Natural Sciences of Philadelphia, the United States National Museum, the Illinois State Laboratory of Natural Sciences, and the State Museum in Albany.

Furthermore, we are greatly indebted to Prof. T. D. A. Cockerell, Prof. J. C. Bradley, Mr. P. B. Powell, Prof. C. P. Gillette, Prof. C. W. Howard, Mr. H. A. Surface, former State Zoologist of Pennsylvania, and Miss Hortense Butler for the collection of valuable material.

Finally, I wish to express my most sincere gratitude to Prof. James G. Needham who has supervised my work. As a student of the group himself, he is not only most ably fitted to guide the work, but his many manuscript notes and sketches of type specimens have been invaluable in making determinations. To him I also wish to extend grateful appreciation for innumerable suggestions and constant advice and encouragement. One of the species, *Dictyogenus ? phaleratus*, which appears for the first time in this paper, I am designating new species Needham, since the description is a quotation of Prof. Needham's manuscript.

*Key to the Pteronarcinae and Perlodini*

a. Reticulate venation extending in the fore-wing from costa through the anal veins ..... **Pteronarcinae**

b. Size large (one and one-half to two and one-half inches); thirteen pairs of tracheal gills ..... **Pteronarcys**

bb. Size small (about three-fourths inches); seventeen pairs of tracheal gills ..... **Pteronarcella**

aa. An apical network of cross-veins restricted to the anterior part of the wings, never extending in the fore-wing, posterior to the cubital veins. **Perlodini**

## Subfamily PTERONARCINAE

### *Adults*

The Pteronarcinae is one of the most distinct groups in the order Plecoptera. Although there is remarkable range of size in the individuals comprising the subfamily, they can be readily distinguished from all others by a reticulate venation reaching in the fore-wing from costa through the anal veins. In addition they are one of the few groups of the order which retain in the adult stage the rudiments of the tracheal gills. But the form of the gills, which are tufts of fine filaments, and their position, which is on the basal abdominal segments as well as on the venter of the thorax, is peculiar to them.

*Nymphs*

The nymphs of this sub-family are perhaps more distinct than the adults. Their bodies are much more cylindrical than those of any of the other members of the group and their coloration is striking. They are a uniform chocolate brown with conspicuous tufts of bushy, white, tracheal gills on the venter.

**PTERONARCYS** Newman

1838. *Pteronarcys* Newman, Ent. Mag., 5: 175.
1842. *Pteronarcys* Pictet, Perlides, p. 125.
1842. *Pteronarcys* Rambur, Hist. Nat. Ins. Neur., p. 449.
1861. *Pteronarcys* Hagen, Syn. Neur. N. A., p. 14.
1876. *Pteronarcys* Provancher, Le Nat. Can., 8: 188.
1877. *Pteronarcys* Hagen, Stett. Ent. Zeit., 38: 477.
1883. *Pteronarcys* Provancher, Pet. Faun. Can. Néurop., p. 67.
1906. *Pteronarcys* Banks, Proc. Ent. Soc. Wash., 8: 8.
1907. *Pteronarcys* Klapálek, Bull. internat. Acad. Sci. Bohême, 12, page 1 of reprint.

*Adult*

This genus contains the largest stone-flies of the entire order. They are dark brown insects with strong, elongated bodies; rather triangular heads; long, slender antennae; short, stout setae; and large wings, heavily net-veined (fig. 9).

Dark fuscous, with varied markings of paler colors, rufous, orange and yellow. Head with prominent rounded eyes; three ocelli forming an equilateral triangle; outside the lateral ocelli conspicuous round spots of a paler color, or dark and shining; supra-antennal plate well developed; antennae long, and tapering.

Prothorax wider than long, a little broader posteriorly, sides and front about straight, hind margin convex, angles sharp, a more or less prominent median yellow line, embossed markings on the disc. The distal end of the femur with a triangular notch on the inner surface; the segments of the tarsi of unequal length, the first segment twice as long as the second, which is the shortest, and the third a little longer than one plus two. The remains of thirteen pairs of tufted gills carried over from those of the nymph, but small, shrivelled and inconspicuous. Wings large, somewhat clouded on the veins, venation reticulate.

Abdomen cylindric, setae dark brown, paler at base. The instability of the color markings in this genus is so great as to

make them of little value in identification, but the structural modifications in genitalia serve as excellent specific characters. A few are generic; in the male, the tenth tergite is bifid (fig. 1), the supra-anal plate is remarkably modified, it is either produced and curved ventralward as a sperm-conveyer (fig. 1 Sup. A. P.), or it is an erect, probe-like organ (fig. 12). In the female the tenth tergite is entire, narrow below, and above produced into a triangular process; the supra-anal plate is a fleshy lobe attached to the ventral surface of the tenth dorsal segment (fig. 2 Sup. A. P.) and the sub-anal plates are triangular (fig. 2 Sub. A. P.).

We have representatives of all the North American species. Some species are represented by pinned specimens only, others by alcoholics as well. Wherever possible the latter are used for structural characters, and the dry specimens for color markings.

*Nymph*

Large ($1\frac{1}{4}$ in.), stout-bodied, concolorous nymphs with smooth bodies; long, slender antennae; short, stout, tapering setae; easily distinguished from all other stone-fly nymphs (except those of *Pteronarcella*, a genus of much smaller individuals) by the presence of tracheal gills on the basal segments of the abdomen.

Dark brown, head narrower than the prothorax, and slightly covered by its front margin. Three small ocelli forming an equilateral triangle; the distance from the lateral ocelli to the inner margin of the eyes equal to the distance between the ocelli. On either side of the ocellar triangle a round, rufous spot, a smaller and less conspicuous one anterior to it, a rufous V-shaped mark opening forward with its base in the median ocellus. The occipital margin with reticulate corrugations. Antennae long and tapering, well developed supra-antennal plates.

Prothorax about twice as wide as long; its sides flaring, the four angles produced. The three thoracic segments obscurely marked with rufous on the disc. Legs, stout; the distal end of the femur triangularly notched on the inner surface; the segments of the tarsus of unequal length, the second segment the shortest, half as long as the first; the third, as long again as one and two taken together.

Abdomen cylindric, the tenth segment narrow below, prolonged above into a median, conical process; the supra-anal

plate a small fleshy lobe attached to the ventral surface of the tenth tergite (figs. 20 and 21 Sup. A. P.), sub-anal plates large, triangular (figs. 20 and 21 Sub. A. P.).

Tufts of filamentous tracheal gills grouped about the legs on the ventral side of the thorax, and beneath the abdomen; anterior to the front legs, three pairs of gills arranged transversely, encircling the neck like a collar, posterior to the same legs, four pairs; posterior to the middle legs, three pairs; posterior to the last pair of legs, three pairs, one on the metathorax and one pair on each of the first two abdominal segments (fig 27).

*Biology and Morphology*

1840. Gosse, Canadian Naturalist: 231, 232.
1844. Newport, Ann. Nat. Hist., 13: 21 to 25.
1851. Newport, Trans. Linn. Soc. London, 20: 433 to 452.
1873. Gerstaecker, Zur Morphologie die Orthoptera amphibiotica, pp. 60 to 74.
1877. Hagen, Stett. Ent. Zeit., 38: 477 to 489.
1883. Packard, Third Rept. U. S. Ent. Com., pp. 322 to 325.

*Biological Notes*

*Adult.* The genus *Pteronarcys* has attracted attention since 1844 when Newport discovered that the adult retained, in a more or less imperfect state, the tracheal gills of the nymph. Some of the early naturalists considered *Pteronarcys* a nocturnal insect. Barnston saw *Pt. regalis* abroad only at dewfall, or in the night, and he observed it "constantly dipping to the surface of the water." Doubleday captured it chiefly "on wet evenings," by day he saw it hidden in crevices of rocks that were constantly wetted by the spray of falling water or under rocks, and in other damp places. Gosse found *Pt. proteus* at the Magog River in great numbers hanging to the rocky sides wet by the spray from the water-fall, or concealed in crevices of the rocks.

Newport interpreted this nocturnal habit as evidence of aquatic respiration in the adult. He says,

"They shun the open day, during which they remain secluded beneath stones or in damp places, where the air is charged with moisture. They come abroad at night, and are constantly in the neighborhood of streams and rivers, in which localities also the air is saturated with moisture. Under either of these circumstances the branchiae may be sufficient for all purposes of aeration."

In commenting on Barnston's observation of the adults dipping to the surface of the water, he suggested that the insect might be diving in search of food, or the female descending below the surface to deposit her eggs.

In 1873, Gerstaecker pointed out that Newport would have seen the fallacy of all such hypotheses had he observed any of the adults of the usual type, without gills, because they all have the same habit of staying in the region of streams and avoiding sunlight. As for dipping to the surface of the water, it could not be for the purpose of getting food, because, as Pictet noted, the reduction in the mandibles of adult stone-flies indicates that no nourishment is taken in that stage, but the explanation lies in the fact that the females dip to the water to lay their eggs. Gerstaecker, and a few years later Hagen, came to the conclusion which we still hold, that the tracheal gills of the adult are not essential for its existence, they are simply carried over from the nymphal stage, that the adults have the usual aerial method of respiration, being provided with spiracles as well as tracheal gills.

Hagen made some further observations on this genus, especially on the mating habits. By keeping a few adults of *Pt. dorsata* (*regalis*) confined in a large dish he discovered that mating occurred frequently, lasting each time from a quarter to half an hour. The male rested on the female grasping her wings with his feet, then bending the end of the abdomen under that of the female and using the dorsal appendages (that is, the two lobes of the bifid tenth tergite) to open up the genital passage, he quickly brought the penis forward into the vagina. The penis being separated from the opening of the sperm duct by the anus, functioned as a sperm-conveyer. Actual egg-laying was not witnessed, but masses of yellow-green eggs were found on the grass or in the water in the bottom of the dish. In two or three days the egg showed segmentation, but the water was evidently too warm for development to continue.

*Nymph.* There are scarcely any biological data on the nymph. Barnston observed that it constantly resided in the water "at the botton of streams and rivers." I have always found it clinging to the under side of stones in the most rapid parts of streams.

*Morphological Notes*

*Adults.* The interest which centered about the biology of *Pteronarcys* was aroused by the discovery of tracheal gills in the adult. Newport first described them in 1844. His paper contains a detailed discussion of their position and structure. Seven years later he published again on the anatomy of *Pteronarcys.* The article contains a more complete discussion of the gills, notes on the circulation of the blood, an account of the spiracles and the distribution of the trachea, and descriptions of the digestive, nervous and reproductive systems. A summary of his work is expressed in the following quotation:

"*Pteronarcys* retains the larva type of organization in all its structures, branchial organs of respiration, a capacious œsophagus and elongated alimentary canal, and more numerous and separated ganglia in its nerve cord."

Hagen added to, and in part corrected, Newport's work on the structure of the respiratory and reproductive systems.

Packard has contributed a paper on the sclerites of *Pt. californica.*

The most interesting morphological aspect of the genus *Pteronarcys* is found in the structure of the male genitalia. Any one who is familiar with Plecoptera knows what diversity of form the genital armature of the male presents; many groups are so highly specialized that several segments are modified in the formation of the copulatory organs, while in others there are no accessory appendages. *Pteronarcys* falls into the highly specialized group.

The remarkable modifications in *Pt. dorsata* (*regalis*) attracted Hagen's attention and in his paper on the mating habits of that species he discusses the structure in some detail. His manuscript contains further notes and sketches which Dr. Needham has copied and appended with comments of his own. The following description is drawn from both sources. It is the supra-anal plate which is of special interest. Here, in *Pt. dorsata* it is in the form of a sperm-conveyer. It is a median dorsal appendage (text-fig. B) entirely separated from the openings of the sperm ducts on the ninth segment by the anus which occurs on the eleventh. It consists essentially of three parts; an inner part (text-fig. B, I) which is buried in the musculature of the tip of

the abdomen and which is firmly bound by broad bands of muscle (text-fig. B, M) to the second part, a paired central piece called "the link" by Hagen (text-fig. B, L). These muscles move the third part, the free end (text-fig. B, F), in a vertical direction. Between the broad, flattened, distal ends ("para-anal plates" Hagen) (text-fig. B, P. A. P.) of the link opens the anus. The end of the free part of the sperm conveyer is an inverted chitinous bowl or cup (text-figs. B and C, C) containing within itself a membranous, eversible sac (text-fig. C, S) with two tendon attachments; one, probably a protractile tendon, attached at the rim of the cup (text-fig. C, P. T.), noted by Hagen, and the other, a retractor, at the base (text-fig. C, R. T.), first noticed by Dr. Needham.

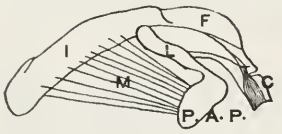


FIGURE B.—*Pteronarcys dorsata* Say. Supra-anal plate or sperm-conveyer, in left lateral view.

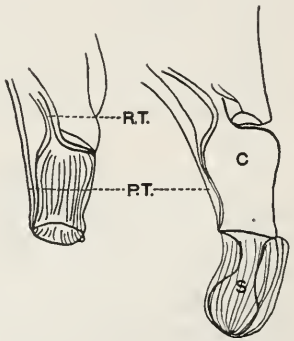


FIGURE C.—*Pteronarcys dorsata* Say. Tip of sperm-conveyer showing membranous sac within, and everted from cup. After Hagen's manuscript.

The structure presumably operates as follows; by the contraction of the muscles (text-fig. B, M.) the end of the penis is brought to the opening of the sperm ducts, then by a tightening of the protractile tendon the membranous sac is everted (text-fig. C, S) and with the suction accompanying its inversion, brought about by the retractile tendon, a sperm mass is drawn into the cup. This filling of the cup supposedly precedes copulation. Then in the same manner by eversion of the sac, the spermatozoa are probably transferred in copulation into the vagina of the female.

In *Pt. nobilis* the structure is practically identical with this in *Pt. dorsata*. *Pt. californica* and *Pt. princeps* are built on the same general plan. The inner part of the sperm-conveyer is much longer (text-fig. D, I), the free part more complicated (text-fig. D, F) and the cup (text-fig. D, C) smaller, but the filling of the sperm cup probably takes place as in *Pt. dorsata*. No tendons are conspicuous in *Pt. californica* or *Pt. princeps*.

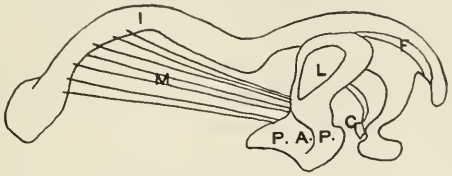


FIGURE D.—*Pteronarcys princeps* Banks. Supra-anal plate or sperm-conveyer, in left lateral view.

*Pt. proteus* and *Pt. biloba* represent another type of genitalia. Superficially the supra-anal plate appears to be totally different from that of the other group, but closer examination shows it to be made up of the same fundamental parts although somewhat modified in form and position. The inner part (fig. 11, I) is much the same aside from being a trifle more slender; the free end (fig. 11, F) is a direct prolongation of the inner part; it is a dorsally flexed, chitinous rod somewhat flattened anterio-posteriorly. In pinned specimens the rod appears to be entirely chitinized but in well preserved alcoholics the posterior surface is covered by a thin, fleshy pad. Surrounding the free end posteriorly and laterally there is a pair of chitinized plates articulated to the median portion (fig. 11, P. G. P.). Their point of attachment marks the boundary between the inner and free parts. Just dorsal to the place of articulation there is a pair of thin, chitinous triangular processes which I have called lateral braces (fig. 11, L. B.). Bands of muscle (fig. 11, M) connect the lateral plates with the inner part. The paired condition of these lateral plates, the presence of the muscle binding them to the inner part, and the position of their point of attachment to the median portion, seem to indicate that they are homologous with Hagen's "link" and "para-anals" in the *Pt. dorsata* type. They no longer lie vertically but have shifted to a horizontal position, the anus

opening ventral to them instead of between them. Thus Hagen's term, "para-anals," for the distal portions is not applicable here. Consequently I have termed the entire plates para-genitals.

A change of function has presumably accompanied the change in form of the free end of the supra-anal. It seems rather likely that it may be used as a probe-like organ in opening up the genital passage of the female. Since the supra-anal plate is apparently entirely accessory, the placing of the spermatazoa into the body of the female must take place in another way, probably by means of a true penis—one directly connected with the sperm ducts. Such a penis has been observed in *Perla immarginata*.[1] Here it is a soft, fleshy, contractile organ entirely concealed within the body except at the time of copulation, when it is protruded from the posterior border of the ninth sternite. The same kind has been found in *Isogenus frontalis* and *Perla decipiens*, and is undoubtedly the more common, and more primitive structure for the transference of spermatozoa in stone-flies.

### *Keys to Species of Pteronarcys Newman*

### *Adults*

### Males

a. The ninth ventral segment elongate, with a notched tip, the tenth tergite bifid and its two lobes elongate, appendage-like.

b. Tips of the notch at apex of the ninth sternite straight or curved ventralward.

c. Tips of the notch at apex of the ninth sternite straight. Tips of the tenth tergite strongly bent upward, emarginate on opposed inner edges. . . . . **dorsata**

cc. Tips of the notch at apex of the ninth sternite curved ventralward. Tips of the tenth tergite only slightly curved dorsalward, inner margins entire . . . . . **nobilis**

aa. The ninth ventral segment truncate, the tenth tergite bifid with rounded lobes.

b. Sub-anal plates broadly triangular, supra-anal plate developed as a sperm-conveyer of remarkable form, curved ventralward.

c. Lobes of the tenth tergite, large, erect; sperm-conveyer flat above. **californica**

cc. Lobes of the tenth tergite, small, erect; sperm-conveyer, evenly rounded above . . . . . **princeps**

bb. Sub-anal plates spoon-shaped, supra-anal plate modified in the form of an erect probe.

[1] The Biology of Perla immarginata Say. L. W. Smith, Annals Ent. Soc. Amer., 6: 1913.

c. A narrow cleft between the lobes of the tenth tergite, large, oval horny areas on either side; on the ninth tergite a median rounded projection pointing anteriorly ..... **proteus**
cc. A wide cleft between the lobes of the tenth tergite; small oval areas on either side; no projection on the ninth tergite ..... **biloba**

## Females

a. Eighth ventral segment without conspicuous median processes or teeth.
b. Posterior margin straight (or nearly so) or triangularly produced.
c. Posterior margin straight (or nearly so) with or without a small incision.
d. Without any incision ..... **dorsata**
dd. With a small rectangular incision ..... **nobilis**
cc. Posterior margin triangularly produced ..... **comstocki**
aa. Eighth ventral segment with a conspicuous pair of tooth- or spine-like processes.
b. With a pair of broad tooth-like or somewhat triangular processes.
c. The entire segment not modified in the formation of the processes.
d. Processes arise before the posterior margin of the segment.
e. Processes about as long as wide at base, inner margins straight, outer oblique; distance between the processes at their base, less than their breadth at base ..... **californica**
ee. Processes considerably longer than broad; inner margins straight or slightly concave, outer, oblique or a trifle convex; distance between processes at base, about equal to their breadth at base .... **princeps**
cc. The entire segment modified in the formation of the processes. Entire segment cleft, anterior part of each half prolonged into a process with inner margin concave and outer convex. Processes reach nearly across segment nine ..... **biloba**
bb. With a pair of median spine-like processes.
c. Processes arise in posterior half of segment, extend half way across segment nine ..... **proteus**

## Nymphs

a. No lateral, apical hooks on abdominal segments. Supra-antennal plate blunt or ending in sharp tooth, and angles of prothorax produced laterally.
c. Supra-antennal plate blunt, and lateral prothoracic teeth short. **dorsata**
cc. Supra-antennal plate ending in a sharp tooth and lateral prothoracic teeth long ..... **californica**
aa. Lateral, apical hooks on abdominal segments, one to eight. Hooks close to body or standing well out from it.
b. Hooks close to body, inconspicuous on segments seven and eight. **proteus**
bb. Hooks well out from body, those on the seventh and eighth segments as conspicuous as the preceding ones ..... **biloba**

**Pteronarcys dorsata** (Say)

Adult

1823. *Sialis dorsata* Say, West. Quart. Rept., 2: 164.
1859. *Sialis dorsata* Say (*Perla* Geoffr., Say M. S. correction), Le Conte Ed., 1: 174.
1861. *Perla dorsata*, Hagen, Syn. Neur. N. A., p. 20.
1892. ?*Pteronarcys dorsata* Banks, Trans. Am. Ent. Soc., 19: 341.
1876. *Pteronarcys rectus* Provancher, Le Nat. Can., 8: 189.
1877. *Pteronarcys rectus* Hagen, Stett. Ent. Zeit., 38: 481.
1878. *Pteronarcys rectus* Provancher, Le Nat. Can., 10: 125.
1883. *Pteronarcys rectus* Provancher, Pet. Faun. Can. Néurop., p. 68.
1838. *Pteronarcys regalis* Newman, Ent. Mag., 5: 176.
1839. *Pteronarcys regalis* Newman, Mag. Nat. Hist., 3: 34.
1841. *Pteronarcys regalis* Pictet, Perlides, p. 134.
1851. *Pteronarcys regalis* Newport, Trans. Linn. Soc., 20: 425.
1861. *Pteronarcys regalis* Hagen, Syn. Neur. N. A., p. 15.
1873. *Pteronarcys regalis* Hagen, Proc. Bost. Soc. N. H., 15: 286.
1876. *Pteronarcys regalis* Provancher, Le Nat. Can., 8: 189.
1883. *Pteronarcys regalis* Provancher, Pet. Faun. Can. Néurop., p. 69.
1904. *Pteronarcys regalis* Banks, Proc. Ent. Soc. Wash., 6: 204.
1907. *Pteronarcys regalis* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, page 5 of reprint.
1876. *Pteronarcys flavicornis* Provancher, Le Nat. Can., 8: 191.
1877. *Pteronarcys flavicornis* Hagen, Stett. Ent. Zeit., 38: 481.
1878. *Pteronarcys flavicornis* Provancher, Le Nat. Can., 10: 125.
1883. *Pteronarcys flavicornis* Provancher, Pet. Faun. Can. Néurop., p. 70.
1841. *Kollaria insignis* Pictet, Perlides, p. 123.
1861. *Pteronarcys insignis* Hagen, Syn. Neur. N. A., p. 16.
1873. *Pteronarcys insignis* Hagen, Proc. Bost. Soc. N. H., 15: 287.
1877. *Pteronarcys insignis* Hagen, Stett. Ent. Zeit., 38: 481.
1873. *Pteronarcys frigida* Gerstaecker, Zur Morphologie der Orthoptera amphibiotica, p. 65.
1877. *Pteronarcys frigida* Hagen, Stett. Ent. Zeit., 38: 481.

Nymph

1851. *Pteronarcys regalis* Newport, Trans. Linn. Soc. London, 20: 428.
1873. *Pteronarcys regalis* Hagen, Proc. Bost. Soc. N. H., 5: 285.

*Distribution.*—Labrador; N. Red River; Saskatchewan River; Mackenzie and Slave Rivers; St. Martin's Falls, Albany River, Hudson's Bay; Michipicoten Island, Lake Superior; Maine; Massachusetts; Sandhill River, Minnesota; White Pigeon and Otter Rivers, Michigan; Elkhart, Indiana; Ungava Bay, Hudson Bay Territory; New York; Ohio River; Pennsylvania; District of Columbia.

## Adult

♂.—Length to tip of wings, 40 to 47 mm.; length of antennae, 22 to 25 mm.; length of setae, 10 to 13 mm.; expanse of wings, 70 to 80 mm.

♀.—Length to tip of wings, 50 to 60 mm.; length of antennae, 22 to 26 mm.; length of setae, 12 to 15 mm.; expanse of wings, 86 to 106 mm.

The largest species in the genus; body dark fuscous, varied with paler markings. Head as broad as prothorax; labrum pale; a round, glossy spot either side of the ocellar triangle; supra-antennal plate widest in middle, forming a rounded angle.

Prothorax slightly widened posteriorly; front margin and sides, straight; posterior border convex; angles sharply produced; a median yellow line broader at the ends, interrupted in the middle by darker markings extending across the disc. Trochanters yellowish, knees yellow in some specimens. Wings greyish hyaline with blackish veins, somewhat clouded.

Abdomen pale yellow on the venter, posterior margins of the tergites paler.

*Male.* The ninth ventral segment, elongated toward the setae, with a terminal notch broadly open, the sides of the notch straight. The tenth segment covered below by the ninth; bifid above, its two lobes elongate and appendage-like, the opposed edges emarginate in the apical half, the tips rounded and strongly bent upwards. The sub-anal plates with long, straight, finger-like prolongations, parallel with, and extending beyond, the tips of the ninth ventral segment. The supra-anal plate modified as a sperm-conveyer; above it appears as a narrow trough, between the tips of the prolongations of the ninth ventral segment it curves ventralward and ends in an inverted cup or bowl-like structure (fig. 1).

*Female.* The eighth ventral segment truncate (fig. 2). Two small marginal triangular processes have been described in this species,[2] but as Hagen has pointed out[3] these are mere folds of membrane projecting from the posterior margin on the sides of the genital aperture, and are not always present.

Numerous specimens from the tributaries of the Ohio River, agreeing well with Say's description of *Pt. dorsata* and Newman's type specimen of *Pt. regalis*, have enabled me to reach a decision as to the identity of Say's long-lost species. Described above from many specimens, male and female, from Harrisburg, Pennsylvania; Elkhart, Indiana; and Ithaca, New York.

## Nymph

Length of body, 33 mm.; length of antennae, 18 mm.; length of setae, 12 mm.

Dark brown, paler on the palpi and legs, and a broad median paler area along the entire length of the venter. Antennae uniform in color, of about 68 segments, the supra-antennal plate blunt with rounded corners.

Prothorax, broader behind, front margin and sides straight, hind margin convex, the corners produced laterally and arched upwards (fig. 17).

[2] Hagen, Proc. Bost. Soc. Nat. Hist., 15: 287.

[3] Stett. Ent. Zeit., 38, 1877: 480.

The last dorsal segment of the female narrow, elongated by the supra-anal plate, a long, straight, median, conical process (fig. 21). The supra-anal plate of the male broader and curved downward. The ninth sternite with a truncate prolongation extending over the tenth segment (fig. 20).

We have material from several places; two nymphs from White Pigeon River, Michigan (A. S. Pearse) IV, 13, 1909; two from the Otter River, Baraga County, Michigan; nymphs and exuviae from Elkhart, Indiana, IV, 1902; and exuviae from Ungava Bay, Hudson Bay Territory (L. M. Turner), and from Harrisburg, Pennsylvania.

**Pteronarcys nobilis** Hagen

Adult

1861. *Pteronarcys nobilis* Hagen, Syn. Neur. N. A., p. 15.
1873. *Pteronarcys nobilis* Hagen, Proc. Bost. Soc. N. H., 15: 285.
1894. *Pteronarcys nobilis* Banks, Ent. News, 5: 178.
1907. *Pteronarcys nobilis* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, p. 4 of reprint.
1873. *Pteronarcys pictetii* Hagen, Proc. Bost. Soc. N. H., 15: 286.
1876. *Pteronarcys pictetii* Provancher, Le Nat. Can., 8: 191.
1883. *Pteronarcys pictetii* Provancher, Pet. Faun. Can. Néurop., p. 70.
1907. *Pteronarcys pictetii* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, p. 7 of reprint.
1841. *Pteronarcys proteus* Pictet, Perlides, p. 128.
?1842. *Pteronarcys proteus* Rambur, Hist. Nat. Ins. Neur., p. 449.

*Distribution.*—New York; Tennessee; Kansas; Georgia; Pennsylvania; Minnesota; Canada.

♂.—Length to tip of wings, 31 to 34 mm.; setae, 12 mm.; expanse of wings, 55 to 57 mm.

♀.—Length to tip of wings, 45 to 48 mm.; setae, 11 mm.; expanse of wings, 80 to 84 mm.

Dark fuscous above and on appendages, orange beneath. Head about as wide as prothorax; the spots outside the ocellar triangle dark fuscous or black; supra-antennal plate very narrow.

Prothorax a trifle broader posteriorly, sides straight, front margin slightly convex, hind margin decidedly arcuated, angles sharpened, a more or less conspicuous, median, yellow line, broader at the ends. Wings smoky with dark veins.

Abdomen with a broad orange band beneath, the tip frequently shiny black, the tergites spotted laterally on the posterior margins with orange or rufous.

*Male.* The ninth ventral segment elongate, ending in a broad notch, the sides of the notch straight; the tenth segment concealed below by the ninth, bifid above, its two lobes, elongate and appendage-like, a little shorter than

those of *Pt. dorsata*, the inner edges not emarginate as in *Pt. dorsata*, and the tips only slightly curved upward. The sub-anal plates with long finger-like prolongations parallel with the tips of the ninth ventral segment, and not extending beyond them as in *Pt. dorsata*. The supra-anal plate produced and modified as a sperm-conveyer; above it appears as a narrow trough, between the tips of the prolongations of the sub-anal plates it turns ventralward and ends in a structure similar to an inverted cup (fig. 3).

*Female.* The eighth ventral segment not truncate as described by Hagen, but slightly produced with a median rectangular notch in the tip (♀ *Pt. pictetii* Hagen) (fig. 4).

This species is represented in our collection by nine males; two from Atlanta, Georgia, V, 1, 1908; one from Nashville, Tennessee, IV, 15, 1901; three from St. Paul, Minnesota; one (alcoholic) from New York, VII, 3, 1897; and four females; two from Nashville, Tennessee, IV, 15, 1901, one from St. Paul, Minnesota, and one from Missouri. The type specimen of this species is in the Museum of Comparative Zoology, Cambridge, Mass.

Two instances of occurrence in the same locality of the ♂ *Pt. nobilis* Hagen and the ♀ *Pt. pictetii* Hagen, and the striking similiarity in the coloration of the two, have led to the decision that they represent a single species. The possible synonomy of the two has already been suggested by Klapálek.[4]

Nymph unknown.

**Pteronarcys californica** Newport

Adult

1851. *Pteronarcys californica* Newport, Trans. Linn. Soc. London, 20: 450.
1861. *Pteronarcys californica* Hagen, Syn. Neur. N. A., p. 16.
1873. *Pteronarcys californica* Hagen, Proc. Bost. Soc. N. H., 15: 283.
1873. *Pteronarcys californica* Hagen, Geol. Surv. of Colorado, p. 573.
1883. *Pteronarcys californica* Packard, Third Rept. U. S. Ent. Com., p. 322.
1907. *Pteronarcys californica* Banks, Can. Ent., 39: 327.
1907. *Pteronarcys californica* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, p. 11 of reprint.

Nymph

1873. *Pteronarcys californica* Hagen, Proc. Bost. Soc. N. H., 5: 284.

*Distribution.*—Ogden River, Utah; Washington Territory between Rocky and Cascade Mountains; Platte Canyon, Colorado; Lake Winnipeg; Powder River, Colorado; Vancouver; Pecos, New Mexico; California.

[4] Loc. cit. p. 7.

### Adult

♂.—Length to tip of wings, 33 to 40 mm.; expanse of wings, 58 to 66 mm.

♀.—Length to tip of wings, 41 to 46 mm.; expanse of wings, 72 to 84 mm.

Head and thorax dark fuscous above, paler beneath, abdomen paler. Head as wide as prothorax, spots beyond the lateral ocelli, rufous; supra-antennal plate ending in a sharp tooth. Pronotum nearly as long as broad, anterior border and sides straight, posterior border convex, angles not conspicuously sharpened, median reddish-yellow line broader at ends. Legs dark fuscous.

*Male.* The ninth ventral segment not produced, with a hollowed scar each side, the middle area broader at the base than the tip. The tenth segment very narrow below; bifid above, the lobes, erect, transverse knobs. The sub-anal plates broadly triangular. The supra-anal plate modified as a sperm-conveyer, above it appears as a flat trough, cleft at the tip, on the ventral side it is elongated before the cleft, and ends in a sperm cup (fig. 5).

*Female.* The eighth ventral segment produced before the tip into two flat, tooth-like, or somewhat triangular, processes, oblique outside, and straight inside, reaching half way across the ninth segment, separated by a rounded notch (fig. 6).

We have six males; two from Colorado, VI, 30, 1904, and four (alcoholic) with no locality labels; and six females, two from Colorado, 1904; one from Los Pinos, Colorado, one from California and two (one alcoholic) without locality labels.

### Nymph

Length of body, 34 mm.; length of antennae, 17 mm.; length of setae, 8 mm.

Antennae unicolorous, of about seventy segments; the supra-antennal plate ending in a sharp tooth. Prothorax broader posteriorly; its front and hind margins convex, each angle produced laterally in a long, up-curved tooth, making the sides appear concave (fig. 19).

In the male the supra-anal plate, less tapering, and bent ventralward (fig. 22). In the female the tenth tergite narrow, prolonged in a sharp, median, conical process, the supra-anal plate (fig. 23). Setae of uniform coloration, stout, a little over a fourth the length of the body.

Described from cast skins in which no color pattern was visible.

Exuviae from Platte Canyon, Colorado; Powder River, Colorado; VI, 15, 1883; Pecos, New Mexico; VI, 7, 1903; and immature nymphs from Ogden, Utah.

**Pteronarcys princeps** Banks

### Adult

1907. *Pteronarcys princeps* Banks, Can. Ent., 39: 327.

1907. *Pteronarcys fumipennis* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, p. 11 of reprint.

*Distribution.*—Mission, British Columbia; San Francisco, California; Dilley, Oregon; Washington.

♂.—Length to tip of wings, 36 mm.; length of antennae, 21 mm.; length of setae, 7 mm.; expanse of wings, 68 mm.

♀.—Length to tip of wings, 47 mm.; expanse of wings, 83 mm.

Very dark brown, or black, much darker than any of the other species, paler around bases of appendages. Head about the width of prothorax; spots outside the ocellar triangle dark; supra-antennal plate narrow, posterior angle slightly produced.

Prothorax wider than long, front margin and sides nearly straight, posterior border convex, angles sharp; median reddish-yellow line narrow, more or less interrupted in the middle. Venter of the thorax varied with paler. Legs dull blackish-brown; wings very dark, clouded, veins blackish-brown.

Abdomen paler brown, blackish on the pleura.

*Male.* The genitalia very similar to *Pt. californica*, the ninth ventral segment with hollowed scars on either side, the middle area broader at the base than tip. The tenth segment concealed below by the ninth, bifid above, the lobes, erect, transverse knobs as in *Pt. californica*, but smaller. The sub-anal plates broadly triangular. The supra-anal plate modified as a sperm-conveyer, above it appears as a trough evenly rounded, cleft at the tip. Before the cleft it is prolonged ventralward, ending in a sperm-cup (fig. 7).

*Female.* The entire eighth segment modified in the formation of two large, flat, triangular processes, the cleft between them reaching to the posterior margin of the segment, the opposed margins straight (in one specimen they appear slightly concave), outer margins oblique, or a trifle convex, the processes reaching across segment nine (fig. 8).

We have two males, one (alcoholic) from Dilley, Oregon, and one (alcoholic) from California; three females from California. Hagen's manuscript species, *Pt. infuscata* ♀, and *Pt. nigra* ♂, apparently belong here also. Professor Needham examined the type specimens, and placed them together under the name *Pt. nigra*. They were apparently taken together, both bearing the same label, San Francisco, and they agree well in general coloration. His notes and sketches from the types indicate their synonomy with *Pt. princeps*.

Type specimen of this species in the Bank's collection in the Museum of Comparative Zoology, at Cambridge, Massachusetts.

Nymph unknown.

**Pteronarcys proteus** Newman

### Adult

1838. *Pteronarcys proteus* Newman, Ent. Mag., 5: 177.
1839. *Pteronarcys proteus* Newman, Mag. Nat. Hist., 3: 34.
1861. *Pteronarcys proteus* Hagen, Syn. Neur. N. A., p. 14.
1873. *Pteronarcys proteus* Hagen, Proc. Bost. Soc. N. H., 15: 281.
1894. *Pteronarcys proteus* Brongniart, Recherches sur l'Hist. des Insect. Foss., p. 186.
1907. *Pteronarcys proteus* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, p. 7 of reprint.
1906. *Pteronarcys spinosa* Banks, Proc. Ent. Soc. Wash., 8: 8.
1907. *Pteronarcys spinosa* Klapálek, Bull. Internat. Acad. Sci. Bohême. 12, p. 13 of reprint.

### Nymph

1873. *Pteronarcys proteus* Hagen, Proc. Bost. Soc. N. H., 15: 283.

*Distribution.*—Trenton Falls and Ithaca, New York; Mackenzie River District; North Red River; Hoosac Mountains, Massachusetts; Oregon; Vermont, and California?

### Adult

♂.—Length to tip of wings, 33 mm.; length of antennae, 17 mm.; length of setae, 7 mm.; expanse of wings, 56 mm.

♀.—Length to tip of wings, 40 mm.; length of antennae, 20 mm.; length of setae, 7 mm.; expanse of wings, 70 mm.

Dark fuscous; head a little narrower than prothorax; spots outside the ocellar triangle, rufous. Prothorax slightly widened posteriorly, sides and front border straight, hind margin convex, angles, right but not sharpened; a narrow, more or less obsolete, median, rufous line. Venter of thorax varied with testaceous.

*Male.* The ninth ventral segment not produced, the sides with hollowed scars, the middle area narrow, sides almost straight; the ninth tergite with a horny, rounded projection pointing anteriorly. The tenth segment very narrow below, nearly covered by the ninth; bifid above with rounded lobes, on the opposed margins, close to the posterior border of the segment, prominent, flat, oval, horny areas. The sub-anal plates spoon-shaped, clasping the base of the supra-anal plate, which is modified into a slender, erect, probe-like organ (fig. 12).

*Female.* The eighth ventral segment of this species is not triangularly produced as Newman described it, but it possesses a median sub-marginal pair of spine-like processes extending half way across the ninth segment (fig. 13). Bred specimens have led to the finding of the true female of this species.

Three males (one alcoholic) from Ithaca, New York, and four females, one from Hoosac Mountains, Massachusetts, and three (two alcoholic) from Ithaca. Both males and females of this

species were bred in May 15 to 20, 1899, by Mr. G. H. Jensen; and in May 14 to 21, 1911, by L. W. Smith.

The type specimen of this species is in the British Museum, London.

Nymph

Length of body 32 mm.; length of antennae, 15 mm.; length of setae, 6 mm.

Color dark brown, paler beneath and on all appendages. Antennae of about sixty-five segments; the middle third paler, in exuviae this area shows as a band of white; the supra-antennal plate, blunt with sharp corners.

Prothorax slightly widened posteriorly; its anterior margin and sides slightly arcuated, the posterior border decidedly convex; sides flaring, produced beyond the front and hind margins, forming conspicuous acute angles (fig. 16).

Segments one to eight of the abdomen with lateral apical hooks; the hooks close to the body, the posterior edges not more than half as long as the lateral edges, the hooks on segments seven and eight small and inconspicuous. The supra-anal plate alike in both sexes, a tapering projection of the last dorsal segment (figs. 24 and 25). Setae short, stout, banded with white in the apical half but the tip darker.

Numerous nymphs and exuviae of bred specimens. This species was bred in May 15 to 20, 1899, by Mr. G. H. Jensen, and in May 14 to 21, 1911, by myself.

**Pteronarcys biloba** Newman

Adult

1838. *Pteronarcys biloba* Newman, Ent. Mag., 5: 176.
1839. *Pteronarcys biloba* Newman, Mag. Nat. Hist., 3: 34.
1841. *Pteronarcys biloba* Pictet, Perlides, p. 135.
1861. *Pteronarcys biloba* Hagen, Syn. Neur. N. Am., p. 15.
1873. *Pteronarcys biloba* Hagen, Proc. Bost. Soc. N. H., 15: 284.
1907. *Pteronarcys biloba* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, p. 10 of reprint.
1876. *Pteronarcys bicarinatus* Provancher, Le Nat. Can., 8: 190.
1878. *Pteronarcys bicarinatus* Provancher, Le Nat. Can., 10: 125.
1883. *Pteronarcys bicarinatus* Provancher, Pet. Faun. Can., Néurop., p. 69.

*Distribution.*—Trenton Falls and Ithaca, New York; St. Martin's Falls, Albany River, Hudson's Bay; Black Mountains, North Carolina; Virginia.

♀.—Length to tip of wings, 46 mm.; expanse of wings, 84 mm.

♂.—Length to tip of wings, 34 mm.; expanse of wings, 55 mm.

Dark fuscous above and below,.the head without paler markings except for rufous spots outside the lateral ocelli. Prothorax a little broader posteriorly, front border and sides straight, hind margin slightly arcuated, angles not sharp; a narrow, rufous median line. Legs dark brown, knees paler.

*Male.* The ninth ventral segment slightly produced, forming a short subgenital plate, the posterior border somewhat thickened; two longitudinal carinae divide the plate into three fields, the middle one narrower at tip than base, the lateral areas deeply hollowed. The tenth segment very narrow below; bifid above, a wide cleft separating the two rounded lobes, each with a small, oval, horny area at the base. The sub-anal plates spoon-shaped and clasping the base of the supra-anal plate, which is modified to form a short, stout, erect probe (fig. 14).

*Female.* The entire eighth sternite involved in the formation of the vulvar lamina; a deep median cleft divides the segment into two flat, obtuse processes, whose opposed edges are straight at the base, concave in the apical half, and the outer edges, convex (fig. 10).

Two males, one from Black Mountains, North Carolina, and the other (alcoholic) from Ithaca, New York, May, 1891, and one female without locality data.

Newman's type specimen is in the British Museum, London.

### Nymph

I am placing this undescribed nymph here tentatively since it was found in the same general region in which the adult occurs, and since it is similar to the nymph of *Pt. proteus* Newman,—the adults of the two species being closely allied. The general color is perhaps a little darker than *Pt. proteus*, and the posterior angles of the prothorax may be a little more produced (fig. 18). The chief difference, and the only one recognizable without the two for comparison, is in the lateral hooks on the abdomen. In *Pt. biloba* they stand well out from the body, the posterior and lateral edges being about equal in length, and the hooks on the seventh and eighth segments are as prominent as those on the preceding segments (fig. 26). In *Pt. proteus* the hooks are close to the body, and those on segments seven and eight are small and inconspicuous.

A number of immature female specimens from Virginia (MacDonald) are in hand.

**Pteronarcys comstocki** new species

1838. ♀ *Pteronarcys proteus* Newman, Ent. Mag., 5: 177.
1839. ♀ *Pteronarcys proteus* Newman, Mag. Nat. Hist., 3: 34.
1873. ♀ *Pteronarcys proteus* Hagen, Proc. Bost. Soc. N. H., 15: 281.
1907. ♀ *Pteronarcys proteus* Klapálek, Bull. Internat. Acad. Sci. Bohême, 12, p. 7 of reprint.

*Distribution.*—Trenton Falls and Wilmurt, New York.

The female formerly called *Pt. proteus* is here renamed *Pt. comstocki.*

♀.—Length to tip of wings, 52 mm.; expanse of wings, 70 mm. (Newman's *Pt. proteus* type).

Head a little narrower than the prothorax. Prothorax slightly widened posteriorly; sides and front border straight; posterior margin convex; angles right; a light triangular spot on median anterior border. Venter of thorax varied with pale markings, posterior margin of the first seven sternites bordered with a narrow, pale band, the eighth, except for the tip, and ninth entirely light.

*Female.* Eighth ventral segment somewhat triangularly produced with a small, median, rectangular, apical notch. The incision has not been noted in previous descriptions, but since it is very inconspicuous, we do not regard it, at present, as a species distinct from that originally described under *Pt. proteus* (fig. 15).

*Type.*—A single pinned specimen in poor condition (faded, having once been in alcohol, and with broken wings), from Wilmurt, New York, (Comstock), in the entomological collection, at Cornell University, Ithaca, New York.

Male unknown.

Nymph unknown.

## **PTERONARCELLA** Banks

1900. *Pteronarcella* Banks, Trans. Amer. Ent. Soc., 26: 242.

### *Adult*

This is a western genus similar to *Pteronarcys*, but smaller. There are other characters as distinctive as the size; the venation is reticulate (fig. 58) but the cross-veins are fewer and more regular, in the fore-wing the cell between the basal part of radius and media is without cross-veins, cubitus has no accessory veins; the supra-antennal plate is not well developed; the angles of the prothorax are not produced; and the genitalia are of quite a different character.

Color, dark brown, varied with darker and lighter markings. Head as broad as prothorax; ocelli well developed, forming an equilateral triangle; a blackish rectangular spot across the ocellar triangle, on either side beyond the blackish area a pale, flattened tubercle, anterior to it, the lateral margin carinated; antennae slender.

Prothorax about square, perhaps a little wider than long, angles rounded, not produced, the disc corrugated; the three thoracic segments very dark above, paler beneath. Wings very much reduced in size in the males of some species, veins brown. The inner surface of the femur with a triangular groove, its base at the distal end, the segments of the tarsi of unequal length, the second the shortest, half as long as the first, the third as long as one and two taken together.

Abdomen cylindric, paler beneath. Setae long and slender, bases stout, the first five basal segments very short. Seventeen pairs of tracheal gills, small and inconspicuous, carried over from the nymph.

*Male.* The ninth segment very much elongated above and below, entirely concealing the tenth segment and the supra-anal plate (fig. 28); sub-anal plates conspicuous (fig. 28, Sub. A. P.).

*Female.* The tenth segment narrow below, triangularly produced above, the supra-anal plate a rounded fleshy lobe attached to the ventral surface of the tenth tergite; sub-anal plates triangular (fig. 29).

### *Nymph*

Nymphs very similar to *Pteronarcys* but readily distinguished from them by their smaller size (when grown about three-fourths inch), and the presence of a pair of tracheal gills on the third segment of the abdomen, as well as a pair on each of the first two segments, as in *Pteronarcys*.

Color nearly uniform, brown. Head rather triangular, much narrower than the prothorax; three small ocelli forming an equilateral triangle; paler, inconspicuous markings on this disc, antennae slender, tapering, a little less than half the length of the body; supra-antennal plate narrow.

Prothorax considerably broader than long; sides, flaring, convex, angles well rounded, more or less obsolete embossed markings on the disc. Legs stout, the inner surface of the femur with a triangular groove, its base at the distal end; the segments of the tarsi of unequal length, the second is the shortest, and is half as long as the first, the third is twice as long as the first two taken together.

Abdomen cylindric, the tenth segment narrow below, prolonged above into a triangular process ending in a sharp spine (fig. 34); the supra-anal plate, a rounded fleshy lobe, attached to the ventral surface of the tenth dorsal segment (fig. 34 Sup. A. P.); the sub-anal plates, triangular, divergent at the tips (fig. 34 Sub. A. P.). Setae, slender, tapering, a little more than a third as long as the body.

Seventeen pairs of tufted tracheal gills on the ventral side of the thorax and the basal segments of the abdomen, arranged in the following manner, three pairs in the integument of the neck, forming a collar, one pair (much smaller) on the lateral anterior margin of the base of the front legs, four pairs arranged around the posterior margin of the same pair of legs, a single pair on the median anterior margin of the base of the second pair of legs, three pairs arranged around the posterior margin of the base of the third pair of legs, one pair (much smaller) on the lateral posterior margin of the same legs; three pairs, one on each of the first three abdominal segments (fig. 33).

*Morphological Notes*

The genus *Pteronarcella* is as yet so little known that the literature contains absolutely no biological and morphological data concerning it.

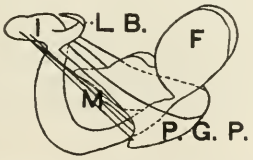


FIGURE E.—*Pteronarcella regularis* Hagen. Supra-anal plate in left lateral view.

Although the supra-anal plate of the male is normally completely hidden, it has been dissected out in *Pteronarcella regularis*. It is of considerable interest in establishing a further bond of kinship between this genus and *Pteronarcys*. It is through the *proteus* type of *Pteronarcys* that the relationship can be traced. The supra-anal plate consists of the same essential parts although decided differences in detail are very evident.

Among these are the considerably shortened inner end (fig. E, I) and the greater development of the lateral braces (fig. E, L. B.). In size the braces are not relatively larger than those in *Pt. proteus*, but they are much more heavily chitinized and consequently much stronger. It seems probable that the reduction of the inner end has necessitated some such lateral extension to strengthen the place of attachment of the supra-anal within the body. The relative position, attachment and muscular connection (fig. E, M) of the para-genital plates (fig. E, P. G. P.) is the same as in *Pt. proteus*. The free end (fig. E, F) is curiously modified at the extremity. It is made up of a pair of partially chitinized semi-elliptical plates, attached to each other at the posterior margins only, just ventral to the base of these hangs a pair of delicate heart-shaped membranous sacs. Just what the function of such a structure might be is puzzling. It is probably of accessory nature and here again the presence of a true penis on segment nine, connected with the sperm-ducts is assumed.

### *Keys to Species of Pteronarcella*

#### *Adults*

#### Males

a. The dorso-lateral posterior margin of the second segment without a conspicuous rounded knob (knobs conspicuous only on segments four or five to nine), the ninth dorsal segment with a broad scoop, sub-anal plates dark brown . . . . . **regularis**

aa. The dorso-lateral posterior margin of the second segment with a conspicuous rounded knob (segments two to nine with prominent knobs), the ninth dorsal segment with a shallow, narrow scoop, subanal plate whitish. **torosa**

#### Females

a. The entire length of the eighth ventral segment involved in the formation of the vulvar lamina, and the median area of the posterior border produced. (The vulvar lamina with a trilobed tip or a single lobe.)

b. A single lobe with a more or less conspicuous notch in the tip. **regularis**

bb. A trilobed tip, the middle lobe the longest . . . . . **triloba**

aa. The posterior border only of the eighth ventral segment involved in the formation of the vulvar lamina, the median area not produced. (A rounded knob on either side of the median area, the part between the notches, a narrow lobe not reaching the border of the segment) . . . . . **badia**

Nymphs

a. With thick fringes on the femora and tibiae, and the filaments of the gills rather stout, erect ..... "a"
aa. Without thick fringes on the femora and tibiae, and the filaments of the gills, thread-like, long, slender ..... **torosa**

**Pteronarcella regularis** Hagen

Adult

1873. *Pteronarcys regularis* Hagen, Bull. Geol. Surv. of Col., p. 573.
1900. *Pteronarcella regularis* Banks, Trans. Amer. Ent. Soc., 26: 242.

*Distribution.*—Sierra Nevada; Selkirk Mountains, British Columbia; Wyoming; Colorado.

♂.—Long-winged,—length to tip of wings, 15 to 17 mm.; expanse of wings, 28 mm. Short-winged,—length to tip of abdomen, 12 mm.; expanse of wings, 18 mm.

♀.—Length to tip of wings, 19 mm.; length of antennae, 11 mm.; length of setae, 8 mm.; expanse of wings, 35 mm.

Dark brown, paler beneath. Head as broad as prothorax; lateral anterior margins carinated; a blackish spot through the ocelli, at the level of the anterior ocellus a lateral extension reaching the carinae, which are also blackish, a little before the posterior ocelli another lateral extension, in most cases less conspicuous than the anterior one and in some specimens entirely lacking; on either side between the lateral bands a prominent, pale yellow tubercle; usually a dark brown patch on either side on the occipital margin. The ventral aspect of the basal segments of the antennae often yellow.

Prothorax nearly square, the width a little greater than the length, sides straight, front and hind margins very slightly convex, angles rounded, a more or less conspicuous, median, yellow line, embossed markings on the disc. Tarsi pale beneath, very dark brown above, especially the second and third segments. Wings hyaline, veins strong, dark brown. Both long and short winged males in this species.

Abdomen cylindric, paler beneath, and in some specimens a tendency for a paler dorsum, sides dark.

*Male.* The dorso-lateral posterior margins of segments three to nine with rounded, hairy knobs—those on the third and fourth segments more or less small and inconspicuous, the others prominent. Segment nine greatly produced, the posterior border truncate, on the dorsum between the two lateral knobs a broad scoop-like prolongation pointing anteriorly. On the venter the middle area of segment nine, cut off by lateral carinae, the posterior border produced and evenly rounded. The tenth segment and the supra-anal plate completely hidden by the ninth segment. The sub-anal plates dark brown, with dorsal appendage-like processes curved anteriorly, their tips reaching the base of the "scoop" (fig. 28).

*Female.* The vulvar lamina almost as broad as the segment at the base, sides gradually sloping to a narrow rounded tip, produced beyond the posterior

border of the segment, tip more or less conspicuously notched, the middle area dark brown, chitinous, sides, pale, membranous. The lamina is not separate from the eighth segment, but is formed by deep lateral folds of the segment and its tip is continuous with the border of the segment (fig. 29).

Four males, one from Selkirk Mountains, British Columbia (Bradley), VIII, 13, 1905; one (short-winged) from Colorado, and two with no data, but probably from Colorado.

Eight females, two taken with the male in the Selkirk Mountains; one from Yellowstone Park, Wyoming; two from Manitou, Colorado, VI, 3, 1879 (Ill. State Lab. Collection) and three with no locality label (Acad. Nat. Sci. Phila.).

The type specimen of this species is in the Museum of Comparative Zoology, Cambridge, Mass.

Nymph unknown.

**Pteronarcella badia** Hagen

Adult

1873. *Pteronarcys badius* Hagen, Bull. Geol. Surv. of Col., p. 573.
1900. *Pteronarcella badia* Banks, Trans. Amer. Ent. Soc., 26: 242.

*Distribution.*—Bridger Basin, Wyoming; Cache Valley, Utah; Colorado Mountains.

♀.—Length to tip of wings, 19 mm.; expanse of wings, 34 mm.

Pale brown; anterior part of head yellowish above and below, palpi brown; occipital region brownish with paler irregular sculpturings; the lateral anterior margins carinated; a square black spot around the ocelli, just behind the anterior ocellus, lateral horns extending toward, but not reaching, the carinae; carinae blackish; conspicuous round yellow tubercle on either side posterior to the lateral horns.

Prothorax brownish, slightly broader than long, sides straight, anterior and posterior margins a trifle convex, front angles square but not sharp, hind angles rounded, a yellow spot on the middle of the anterior and posterior margins, not connected by a conspicuous line, coarse paler sculpturings on the disc. Meso- and metathorax dark brown, varied with paler on the venter. Tarsi considerably darker than the other segments of the legs.

Abdomen brown; paler beneath and on the dorso-lateral area of the last four or five segments; setae pale.

*Female.* The posterior margin of the eighth segment notched on either side of the mid-ventral line; the part between the notches chitinized, dark brown, a little produced, but not reaching the border of the segment (fig. 32).

One unlabelled specimen.

Hagen's type specimen is in the Museum of Comparative Zoology, Cambridge, Mass.

Male unknown.

Nymph unknown.

**Pteronarcella torosa** new species

## Adult

*Distribution.*—Santa Fé, New Mexico.

♂.—Length of body, 16 mm.; length of antennae, 11 mm.; expanse of wings, 12 mm.

Pitch brown, paler beneath. Head a little broader than the prothorax, lateral anterior margins carinated, a square black spot across the ocelli; on either side of the ocellar triangle a conspicuous pale yellow tubercle; labrum pale yellow; carinae pale; a broad pale band along the inner margins of the compound eyes, antennae pale, darker toward the tip.

Prothorax dark brown, a little wider than long, sides straight, anterior and posterior margins a little convex; angles round; a small median pale spot on the anterior margin, a larger more prominent one on the posterior border, coarse pale sculpturings on the disc. Meso- and metathorax dark brown above, the entire thorax yellow beneath. Trochanters and coxae yellow. Wings very small, brownish, veins brown, venation greatly reduced.

*Male.* Abdomen cylindric, dark brown above, pale beneath. The first dorsal segment with a conspicuous median whitish spot. The dorso-lateral posterior margins of segments two to nine with prominent, hairy, rounded knobs. The posterior border of the ninth dorsal segment truncate; between the two knobs on this segment a rather shallow, narrow, scoop-like projection pointing anteriorly. The median ventral region of the ninth segment cut off by lateral carinae, its margin produced, evenly rounded. The tenth segment and the supra-anal plate entirely concealed by the ninth. The sub-anal plates pale yellow, with dorsal appendage-like projections pointing anteriorly, the tips reaching the base of the scoop (fig. 30).

Type specimen, a male from Sante Fé, New Mexico, (P. B. Powell), VI, 1, 1904, in the entomological collection at Cornell University, Ithaca, N. Y.

Female unknown.

## Nymph

♂.—Length of body, 16 mm.; length of antennae, 7 mm.; length of setae, 5 mm.

♀.—Length of body, 23 mm.; length of antennae, 8 mm.; length of setae, 8 mm.

Chestnut-brown. Head considerably narrower than prothorax; ocelli blackish; a dark brown, rectangular spot extending through the ocellar triangle, beyond it on either side a pale round spot; palpi pale yellow; antennae light brown, of about forty-one segments, the supra-antennal plate narrow; the occipital margin with reticulate corrugations.

Prothorax nearly twice as broad as long, front margin straight, hind margin and sides convex, angles produced, well rounded; a slight indication of a narrow median yellow line, broadened at the ends; the disc with embossed markings (fig. 37). Legs paler than body, especially tibiae and tarsi.

Abdomen cylindric, three very fine lines extending the length of the abdomen on the dorsum, the basal segments paler on the venter. Setae pale brown. Filaments of the tracheal gills thread-like, long and slender.

*Male.* The tenth dorsal segment produced above in a short, straight spine, below at the base of the spine, a rounded prominence; the supra-anal plate a smaller fleshy lobe attached to the tenth segment below the rounded prominence (fig. 34).

*Female.* The eighth ventral segment with a median depression on the posterior border. The tenth segment narrow below, produced above in a conical process curved upward; the supra-anal plate a fleshy lobe attached to the ventral surface of the tenth tergite (fig. 35).

One male from Sante Fé, New Mexico, (P. B. Powell collector), VI, 1, 1904, and one exuvia taken at the same time, also an exuvia from Pecos, New Mexico, (Prof. T. D. A. Cockerell), VI, 1903. Three females, two from Sante Fé, and one from Pecos, and an exuvia from each place. All of these specimens are at Cornell University. The exuvia from Pecos, New Mexico, June, 1903, is the described specimen.

**Pteronarcella triloba** new species

Adult

♀.—Length to tip of wings, 17 mm.; expanse of wings, 33 mm.

Pale brown. Head as broad as prothorax, lateral anterior margins carinated, anterior part of head darker than posterior, a square black spot through the ocelli continued just behind the anterior ocellus in lateral horns reaching the carinae, carinae very dark brown; on either side posterior to lateral extensions of the black spot, a conspicuous pale yellow tubercle; paler areas around the inner margins of the compound eyes; occipital area corrugated. Antennae dark brown, paler at base.

Prothorax a little broader than long; sides, front and hind margins about straight, angles, rounded, a pale yellow median line, the disc sculptured. Meso- and metathorax dark brown, varied with paler on the venter. Tarsi darker than the other segments of the legs.

Abdomen pale above and below, darker toward the tip. Setae dark brown.

*Female.* The middle area of the eighth ventral segment dark brown, horny, narrower at the base than the tip; the tip three lobed, the middle lobe the longest, extending beyond the border of the segment, the lateral ones, not reaching beyond the border, but continuous with the lateral membranous margin (fig. 31).

One female in alcohol sent to Dr. Needham by C. P. Gillette, from Colorado. This is the type specimen. It is at Cornell University in the entomological collection.

Male unknown.

Nymph unknown.

**Pteronarcella** nymph—**"a"**

♀.—Length of the body, 19 mm.; length of antennae, 9 mm.; length of setae, 7 mm.

Blackish-brown with no conspicuous variation in color or markings except for the thick, white fringes of hair on the legs, and the white tracheal gills. Head very much narrower than the prothorax, ocelli inconspicuous; faint, round spots outside the ocellar triangle. Antennae slender, tapering, of about forty-five segments.

Prothorax almost twice as broad as long, front and hind margins straight; sides, flaring, convex; angles rounded (fig. 38). Legs with heavy fringes of long, white hairs along the outer edge of the femur and tibia.

Abdomen cylindric. Tracheal gills very conspicuous, each tuft composed of many rather stout, erect filaments.

*Female.* The posterior margin of the eighth ventral segment with a median depression; the tenth segment narrow below, produced above into a triangular process ending in a straight, sharp spine; the supra-anal plate, a fleshy lobe attached ventrally to the anterior part of the tenth dorsal segment (fig. 36).

Two female nymphs (alcoholic specimens), not quite mature, from Tyler Lake, Boulder, Colorado, III, 13, 1905. These nymphs are in the entomological collection at Cornell University.

For the present this nymph is left unnamed, since it may belong to one of the Colorado species, *Pteronarcella regularis* or *Pteronarcella badia*.

## PERLODINI

A few years ago Klapálek separated off from the *Perlini*, the genera *Perlodes* Banks, *Isogenus* Newman and a small part of *Perla* Geoffroy, under the name *Perlodidae*. This family contains a number of genera, some made by revision of the old ones, while others are entirely new. He has used venation and genitalia as primary characters for classification. As formerly, in the genera *Perlodes* and *Isogenus*, the chief venational character is the apical network of cross-veins. Klapálek recognizes two groups, one in which "there is present a more or less irregular network of cross-veins in the tip between R, its sector, and the branches of the latter, sometimes even to M, and from its posterior branch to the posterior margin"; and another group in which "the network is lacking and there is a single cross-vein between R and Rs."

Under the tribe *Perlodini* I am including those genera of Klapálek's family *Perlodidae* which have an apical network of

cross-veins, that is those which have more than a single cross-vein between radius and the radial sector. In color these stoneflies are dark brown with markings of yellow; the head is relatively large; the eyes are hemispherical; there are present three small ocelli arranged in an isosceles triangle, the base of which is greater than the sides; the tubercles are more or less conspicuous; the antennae and palpi are slender. The prothorax is broader than long, a median yellow stripe is usually present and the lateral fields are embossed. Legs are rather long; the three segments of the tarsi are of unequal length, the third being the longest, and greater than the first two taken together, the second segment is the shortest, it is half as great as the first. The wings are often shortened, especially in the males. An apical network of cross-veins is always present, its extent and regularity differing in the various genera; the accessory branches of the first cubital vein have a decided anterior flexure; with the exception of *Dictyogenus? phaleratus*, in the fore-wing the first anal vein angled at the base, as it leaves the anal cell it runs forward to the second cubital vein, then it makes an abrupt posterior bend. Another useful venational character of generic importance in this tribe is the relation between the length of the inner inter-radial cell (1st $R_1$) and its base, measured to the point at which the arculus would meet radius if produced. Dr. Ris and Prof. Klapálek have used this character.

Some of the members of this tribe are gill-bearing. In dried specimens the gills are very difficult to detect on account of their shrunken condition and small size. In alcoholics they appear as delicate, white, fleshy, finger-like, blind sacs. Their number varies in different species but is constant within a single species. Other species are without gills.

In the males the ninth sternite is produced in a sub-genital plate; the tenth tergite is bifid in most genera (in all the genera that are known certainly to occur in this country); the sub-anal and supra-anal plates often modified as accessory copulatory organs.

In the females the usual vulvar lamina is present. Klapálek has used its form as a generic character, but his groupings contain such a wide range that they are not especially valuable. However, they serve as excellent specific characters.

*Nymphs*

It is not possible at the present time to more than mention the nymphs of this tribe. Since I have no life history material I have been able to recognize only those nymphs which belong with the gill-bearing species. Of course the form and location of the gills is characteristic. The shape of the head is distinctive also, being curiousy broadened laterally by very large maxillae. In the following specific descriptions two nymphs are described in detail.

*Morphological Notes*

This group, like *Pteronarcella*, is so little known as yet that it has not been studied from biological or morphological viewpoints. At the end of Hagen's description of *Megarcys* (*Dictyogenus*) *signata* he commented upon the fact that the species was of special interest, as an exception to the genus, since it was gill-bearing in the adult, that the hitherto-known species (all exotics) were without them. Among the following descriptions of additional North American species a number of other gill-bearing imagos will be found.

Judging alone from the appearance of the external genitalia of the males of this tribe one would not imagine that a close relationship existed between them. But dissections of the supra-anal plates show not only that the fundamental plan of all of them is identical, but also that it is similar to that of *Pteronarcella* and the *proteus* group of *Pteronarcys*. This tribe appears to have reached a higher degree of specialization in at least one respect, that is in the more complicated form of the outer portion of the free end of the supra-anal plate. In all of these (figs. 40, 45, 50) it is made up of three parts, which I am calling the median and lateral stylets. The paired ones are joined to the median one at the bases only, but they appear to have a secondary connection with the para-genital plates, being bound to them by bands of membranous tissue, so that all movements of the plates involve the stylets in a similar movement.

The variety of form in all the stylets is considerable and of such a character in some instances as to prevent certain conjectures of function. One can doubtless say with a good deal of surety, that whatever their use may be it is as some accessory copulatory organ. It does not seem improbable that the median

one may function as a probe for opening up the vagina of the female. Whether it be a probe or some other intromittent organ, there is present, presumably, a true penis, directly connected with the sperm ducts, for the transference of the spermatozoa.

*Arcynopteryx vagans* is, perhaps, most nearly related to the preceding genera. The inner end (fig. 50, I) is short and stout with its posterior dorsal aspect forked. It seems very probable that the bifid portion represents lateral braces (fig. 50, L. B.) in a more highly developed condition. The free end (fig. 50, F) is made up of the characteristic parts, a stout, chitinous, club-shaped, median stylet surrounded by a membranous sheath (fig. 50, M. S.) and on either side of it, a shorter bifid stylet. These lateral stylets (fig. 50, L. S.) are chitinous but much more delicate than the median one; the two tips are unlike in form, the inner one which is scarcely visible in a side view of the supra-anal plate, is somewhat thumb-shaped, and the outer, longer and more spine-like. Broad para-genital plates (fig. 50, P. G. P.) surround the free end posteriorly and laterally, these are articulated to the posterior margins of the lateral braces, and are joined to the inner end by bands of muscle (fig. 50, M).

In *Protarcys bradleyi* the inner part (fig. 40, I) is reduced to a mere stub, but the lateral braces (fig. 40, L. B.) are correspondingly larger. The median stylet (fig. 40, M. S.) is shorter than the laterals (fig. 40, L. S.); it is not unlike that of *Arcynopteryx vagans* in structure, being a chitinous rod surrounded by a fleshy covering, which is beset with innumerable tiny teeth directed ventrally; the paired stylets are slender tapering rods nearly reaching the dorsal margins of the para-genitals. These latter plates are large and rather triangular in form; they have the usual relations to the other parts already described under *Arcynopteryx vagans*.

The supra-anal plate of *Megarcys signata* has a very curious appearance. The inner end (fig. 45, I) is larger than in the preceding forms and the lateral braces (fig. 45, L. B.) are stout; the greater development of this region is necessitated, perhaps, by the extraordinary size of the rest of the apparatus. The median stylet (fig. 45, M. S.) is a large, flat, triangular, chitinous plate,

the posterior end of which is surrounded by a membranous covering studded laterally and ventrally with minute, triangular teeth; the lateral stylets (fig. 45, L. S.) are flat, elongate lobes with pointed tips. There is nothing unusual in the form of the paragenital plates (fig. 45, P. G. P.) or in the connections with the other parts. Although the form of the median stylet is very different from those just described, it probably functions in the same way. In copulation, if the end of the abdomen were arched dorsalward sufficiently, it would bring the pointed posterior end, anterior in position and it would be introduced into the vagina first. The rough membranous sheath, covering this portion of the stylet, is a further indication that it is the probe end. It is possible that the entire stylet is extended into the vagina; its triangular shape would make it an excellent wedge for prying open the passage.

*Key to Genera of Perlodini*

*Adults*

a. In the fore-wing an apical network of cross-veins extending from costa to cubitus$_1$ ..... **Protarcys**

aa. In the fore-wing an apical network of cross-veins of lesser extent.

b. Costal margin of the wing showing a slight concavity at the humeral cross-vein; the length of the inner inter-radial cell at least twice as great as its base (p. 475); the network of cross-veins restricted to the anterior part of the wing, chiefly between radius and the branches of the sector. **Arcynopteryx**

bb. Costal margin of the wing not showing a slight concavity at the humeral cross-vein; the length of the inner inter-radial cell only a little greater than its base.

c. A rich network of cross-veins extending from costa to media$_1$. **Megarcys signata**

cc. A scanty network of cross-veins restricted to the region between radius$_2$ and media$_1$ ..... **Dictyogenus? phaleratus**

**PERLODES** Banks

1903. *Perlodes* Banks, Ent. News, XIV, p. 241.
1912. *Perlodes* Klapálek, Coll. Selys, 4:31.

In giving the distribution of the genus *Perlodes*, Klapálek says that it is spread over Europe and is represented in America by a single species. Among his specific descriptions we find on page 40 a sketch bearing the legend "*Perlodes transversa* Klp. (Nord Amerika)," but he gives as the basis for the description one

female specimen with the label "Rheinwald" (W. Bennett collector). On account of this apparent discrepancy in locality I am neither accepting *Perlodes transversa* as an American species, nor including *Perlodes* in this tribe, since I have not found any representatives of it among our material.

**PROTARCYS** Klapálek

1912. *Protarcys* Klapálek, Coll. Selys, 4: 8.

"Wings surprisingly short and broad, especially the hind ones. Cross-veins numerous, only lacking in field $M_1$"—translation from Klapálek's description of the genus. The lack of cross-veins in field $M_1$ is not constant in this genus. Klapálek mentions their presence in one of his specific descriptions, *Protarcys caudata* Klp., p. 9. I am, therefore, placing here two American species which have a rich network of cross-veins extending from costa to the second branch of cubitus including field $M_1$. The wings are not surprisingly short and broad, but the similarity between the genitalia of the male which Klapálek describes and figures, and that of the male I am placing here is so striking that it seems to indicate close kinship.

The American species have additional venational characters; the costal margin does not show a slight concavity at the humeral cross-vein, practically the entire costal area beyond the humeral cross-vein is occupied by numerous cross-veins, subcosta runs into radius beyond the level of the cord, the length of the inner inter-radial cell is about a fourth greater than its base, the cord[5] ("anastomosis" of Banks and Klapálek) is well developed. The ninth sternite forms a short, subgenital plate; the tenth tergite is cleft, each lobe being produced into a short, stout projection directed inward and upward; in the species which we have the para-genital plates are the only parts of the supra-anal plate which are visible without dissecting. Both of the American species bear gills.

[5] The fullest discussion of this feature of insect venation is to be found on page 223 of Prof. J. G. Needham's "Report of the Entomological Field Station conducted at Old Forge, N. Y. in the Summer of 1905"—New York State Museum Bulletin 124.

*Key to Species of Protarcys*

Adults

a. With one pair of tracheal gills; the apical network of cross-veins rich and regular (fig. 59) ..... **dolobrata**

aa. With three pairs of tracheal gills, the apical network of cross-veins fairly rich and irregular (fig. 60) ..... **bradleyi**

**Protarcys dolobrata** new species

Adult

♀.—Length to tip of wings, 25 mm.; expanse of wings, 44 mm.

Color, dull, dark brown. Head large, with three small ocelli arranged in an isosceles triangle, the distance between the posterior ocelli half again as great as that between them and the anterior ocellus, and about equal to the distance from them to the inner margin of the eye. Small, round, glossy tubercles much closer to the paired ocelli than to the inner margin of the eyes. M-shaped mark fairly distinct, brownish yellow. Crown-spot and region around the tubercles brownish yellow; median occipital border with a pale yellow triangular spot, lateral occipital areas dull brown with coarse embossings. Under side of head brownish-yellow, palpi of the same color, antennae broken off, except for basal segments which are brown.

Prothorax, trapezoidal, slightly broader than the occiput, considerably narrowed posteriorly, sides straight, front margin a trifle arcuated, posterior border more noticeably convex, angles blunt. A small, pale yellow, median spot on the anterior and posterior margins, a deep median furrow, lateral fields embossed, especially on the inner halves. Venter of thorax pale yellow with a dark brown, median, shield-shaped spot on each of the three segments. Legs dark brown with middle regions of femora and tibiae paler. Wings long and slender, with yellowish-brown venation; costa paler, veins smoky, a rather conspicuous brown spot on the radial cross-vein; apical half of the wings with a rich network of cross-veins extending from costa through cubitus$_2$, cells fairly regular (fig. 59). On a line with the base of the legs on the anterior post-marginal area of the mesothorax a pair of rather short, fleshy gills. The same area on the metathorax is so badly mutilated that it is impossible to determine whether a pair of gills was ever present or not. The part of the body anterior to the mesothorax is perfect and there is no trace of gills there.

*Female.* Abdomen dull brown above and below with the exception of yellowish-brown median areas on the first seven sternites; sub-anal plates and first few basal segments of the setae pale yellow, the following segments pale yellow with narrow apical bands of brown. The vulvar lamina rather long and narrow reaching across segment nine and the basal part of segment ten; semi-elliptical in form, apex truncate (fig. 39).

Type specimen, a single female without a locality label, in the collection of the Academy of Natural Sciences of Philadelphia.

Male unknown.

Nymph unknown.

**Protarcys bradleyi** new species

## Adult

*Distribution.*—Canadian Rocky Mountains.

♂.—Length to tip of wings, 20 mm.; length of antennae, 12 mm.; expanse of wings, 32 mm.

♀.—Length to tip of wings, 23 mm.; length of antennae, 12 mm.; length of setae, 7 mm.; expanse of wings, 37 mm.

Dark brown varied with golden brown and yellow. Head triangular, three moderately large ocelli arranged in an isosceles triangle, the distance between the lateral ocelli one-third greater than the distance from them to the median ocellus and very nearly as great as the distance from them to the inner margin of the eye. The M-shaped mark yellow-brown, glossy, conspicuous; tubercles shiny reddish-brown, in the form of crescents, the distance from them to the posterior ocelli half as great as the distance from them to the inner margin of the eyes. Labrum whitish; clypeus with a yellowish brown, median area and a pale yellow spot toward either anterior corner; a yellow-brown, inverted V-shaped mark passing from the median ocellus backward to the posterior ones; crown suture deep, pale yellow; a large, median, pale yellow, occipital spot which extends laterally in a narrow band along the entire occipital border; the lateral areas of the occiput with rather fine, dark brown sculpturings. Antennae, long, slender, over half the length of the body, the basal segment dark brown, in the male the second and third segments pale and the remainder dark brown, in the female the entire antenna pale brown with the exception of the dark basal segment. Under side of head pale yellow; palpi, white.

Pronotum trapezoidal, anterior border wider than posterior but narrower than the occiput; sides and hind margin straight, front margin a little arcuated, corners squarish; a very dark brown band along the anterior border interrupted in the middle by a median yellow band, moderately broad and dilated posteriorly; the lateral areas darkest in the outer half, coarse, yellowish brown sculpturings in the inner part. Meso- and metanotum dark brown with pale median bands. The entire venter of the thorax yellowish white, with a more or less rectangular dark brown spot toward the middle of each of the three segments. Legs yellowish brown, the distal half of the femora, a band below the knees, the tip of tibiae and the tarsi, darker. Wings yellowish brown, venation rather dark, veins somewhat clouded; an irregular network of cross-veins in the tip of the wing, extending from costa through cubitus, the cross-veins fewer in the median and cubital fields, but not entirely lacking (fig. 60). Three pairs of white, fleshy, tracheal gills in the form of short, slender blind sacs situated as follows: one pair (small and inconspicuous) far apart on the lateral margin of the submentum, and a pair each on the anterior post-marginal border of the meso- and metasternum on a line with the lateral posterior border of the base of the legs.

Abdomen dark brown above with a median pair of narrow paler stripes, conspicuous on the basal segments but gradually becoming fainter toward the tip and disappearing in the male on the fifth segment and in the female on the

eighth. Abdomen pale on the venter in the female, dark in the male. Setae slender, pale brown in the male, yellowish in the female; the distal segments narrowly banded with darker toward the tips.

*Male.* Ninth segment entire above, slightly produced below to form a narrow subgenital plate which extends to the posterior border of the tenth segment. The tenth tergite with a broad median cleft, the opposed edges of the lobes emarginate with a broad, yellow, triangular hollowed spot extending lateralward from the margin and a short, spine-like projection directed obliquely inward and upward on the inner posterior edge of the lobe. Supra-anal plate entirely concealed except for the tips of the lateral braces, which show at the apical border of the ninth tergite, projecting from the inner anterior borders of the cleft of the tenth tergite, as a pair of short, dark brown, triangular processes pointing obliquely upward and outward. Sub-anal plates, flat, triangular, pressed against and meeting at right angles, the para-genitals which appear between the lobes of the cleft and the tenth tergite as a pair of yellowish brown, horizontal, triangular lobes (fig. 41).

*Female.* The posterior border of the eighth ventral segment prolonged about three-quarters of the distance across segment nine, in an evenly rounded subgenital plate (fig. 42). The tenth tergite scarcely elongated; the tips of the sub-anal plates touching its ventral surface and concealing the supra-anal plate, if it is present

We have three specimens collected by J. C. Bradley; one male (alcoholic) from Lake Louise, Canadian Rockies, VI, 25, 1908; and two females, one (alcoholic) from Rogers Pass, (altitude 4500 to 5000 feet) British Columbia, VIII, 7, 1908; and one from Ground Hog Basin (altitude over 6000 feet), Selkirk Mountains, British Columbia, VII, 22 to VIII, 7, 1905. The male is the type specimen and the female from Rogers Pass, the allotype. These are at Cornell University in the entomological collection.

Nymph unknown.

### MEGARCYS Klapálek

1912. *Megarcys* Klapálek, Coll. Selys, 4: 10.

In characterizing this genus Klapálek says it is quite close to *Arcynopteryx* in the structure of the genital appendages, but it is sufficiently distinct from it in having a much richer network of cross-veins. To enlarge upon Klapálek's statement, in the male the ninth sternite is produced to form a subgenital plate, the tenth tergite is bifid, the inner posterior margin of either lobe is prolonged into an appendage-like process directed upward; the sub-anal plates are flat, and triangular; the supra-anal plate consists of a pair of para-genitals, a median and two lateral

stylets. In *Megarcys signata* only the tips of the lateral stylets are visible, they are so closely applied to the median one that they are very inconspicuous. In this same species the apical network of cross-veins is rather irregular, it extends from costa to media$_1$, the costal border does not show a slight concavity at the humeral cross-vein, the first third or fourth of the costal area beyond the humeral cross-vein is free from cross-veins, the remainder of that area is more or less closely traversed with cross-veins; subcosta runs into radius beyond the level of the cord; the length of the inner inter-radial cell is a fourth greater than its base in females and long winged males, and about equal to its base in short winged males; cord well developed. *Megarcys signata* bears gills.

**Megarcys signata** Hagen

1873. *Dictyopteryx signata* Hagen, Bull. Geol. Surv. Terr., p. 575.
1907. *Perlodes signata* Banks, Cat. Neur. Ins., p. 10.
1907. *Perlodes signata* Banks, Can. Ent., 39: 327.
1912. *Megarcys signata* Klapálek, Coll. Selys, 4: 12.
1900. *Dictyopteryx irregularis* Banks, Trans. Ann. Ent. Soc., 26: 243.
1907. *Perlodes irregularis* Banks, Cat. Neur. Ins., p. 10.
1907. *Perlodes irregularis* Banks, Can. Ent., 39: 327.
1912. *Megarcys irregularis* Klapálek, Coll. Selys, 4: 12.

*Distribution.*—Colorado; Mountains of Pacific Coast; Ashford, Washington; British Columbia; Wyoming.

♂.—Long winged, length to tip of wings, 20 mm.; expanse of wings, 30 mm.

♂.—Short winged, length to tip of abdomen, 16 mm.; expanse of wings, 18 mm.

♂.—Length of antennae, 12 mm.; length of setae, 9 mm.

♀.—Length to tip of wings, 25 mm.; length of antennae, 12 mm.; length of setae, 11 mm.; expanse of wings, 42 mm.

Yellowish-brown varied with yellow, paler beneath. Head flat, triangular. Three small ocelli forming an isosceles triangle, the base of the triangle greater than the sides, in the male the distance from the inner margin of the eye to the posterior ocellus less than the distance between the anterior and posterior ocelli; in the female the distances about equal. On either side outside the ocellar triangle is a small rather inconspicuous tubercle. Color pattern of the head more or less variable; labrum pale yellow, entire clypeus pale, or frequently only the middle portion pale with the sides brown, the M-shaped mark varying from pale yellow to brown; a pale spot between the ocelli, and three on the occipital margin, in some specimens the middle one small and triangular, narrowly connected with the crown spot, in other specimens the middle spot broadly confluent with the crown spot; the lateral occipital spots more or less

conspicuously corrugated with brown. Antennae pale brown, first segment with a tendency toward darker coloration above. Under side of head pale; palpi pale to brownish.

Pronotum yellowish-brown, about as broad as the head, nearly square, in one male specimen slightly wider posteriorly; occasionally anterior and posterior margins a trifle arcuated; a broad, median, yellow band dilated at either end, the posterior dilation greater than the anterior, in some specimens a fine, brown stripe running through the center of the yellow band, the lateral areas conspicuously marked with shiny, brown embossings. Above, the meso- and metathorax glossy dark brown with a pale, median, narrow, triangular spot on the anterior border. The entire thorax whitish beneath, with darker markings on the middle areas. Legs yellowish-brown, femora with stripes of brown along the outer aspect, broadening into a ring above the knees, base of tibiae and tip of tarsi dark brown. Wings brownish-yellow, darker on the costal margin, a rich network of cross-veins in the apical part of the wing in the region anterior to media (fig. 61). Males both long and short winged. Four pairs of tracheal gills (not five as stated by Hagen p. 576) in the form of small, white, fleshy, blind sacs, situated as follows; one pair placed far apart on the basal portion of the submentum and pointing outward, a pair on the prothorax a little lateral and anterior to the base of the fore legs, and a pair on the anterior post-marginal area of each of the last two thoracic segments on a line with the base of the legs, these point obliquely inward and downward.

Abdomen dark brown above, pale at the tip and beneath, setae about two-thirds as long as the body, brownish, darkest at the tips of the segments.

*Male.* The apical half of the ninth segment, yellow; on the dorsum its posterior border recurvate, transversely cariniform, thickened, slightly emarginate in the middle region, villous; on the venter the ninth segment considerably produced with an elliptical margin. The tenth segment concealed by the ninth below, cleft above with yellow, appendage-like, spinous, processes directed upward, on the inner posterior margin of either lobe. In one specimen a brown band across the process, just before the tip. Between the posterior border of the tenth dorsal segment and the sub-anal plates the para-genitals show on either side of the stylets. The median stylet rises above the paragenitals as a thin, rod-like appendage directed obliquely backward, the anterior portion is brown, while the posterior part appears white, being ensheathed with a membranous covering, on either side of the anterior portion of the central portion of the stylet, and closely opposed to it, the laterals show as small triangular plates (fig. 43).

*Female.* Subgenital plate large, reaching about two-thirds across segment nine, and nearly three-quarters as wide as the segment, with a deep, narrow median cleft forming two circular lobes very close together. The tenth tergite triangularly produced with a slight, median longitudinal depression (fig. 44).

We have four males (three alcoholic); one (long-winged) from Howser, Selkirk Mountains, British Columbia, VI, 22, 1905 (Bradley); one (short-winged) from Emerald Lake, Canadian

Rockies, VII, 4, 1908 (Bradley), and two, one (long-winged) and one (short-winged), from Wyoming; also five females (all alcoholic), four from Rogers Pass, Selkirk Mountains, British Columbia, VIII, 1908 (Bradley), and one from Wyoming. Hagen gives September as the date of occurrence for the foothills of Colorado, and August 16 to September 6 for the mountains of the Pacific Slope.

Type specimen of species in the Museum of Comparative Zoology, Cambridge, Mass.

## Nymph

Immature nymphs. Length to tip of abdomen, 18 mm.

Color, pale yellow-brown varied with yellowish markings. Head squarish, considerably broadened on the sides by enormous maxillae. Three small ocelli arranged in an isosceles triangle, the side of which is less than the base but equal to the distance from the inner margin of the eyes to the posterior ocelli. On either side of the ocellar triangle a pale yellow tubercle, a prominent M-shaped mark of the same color, the region anterior to the middle part of the M also pale, labrum and lateral portions of clypeus brown; lateral occipital areas with rather large, oval spots, in some specimens also a small, triangular median occipital spot and an indistinct one between the ocelli. Under side of head, palpi and antennae pale.

Pronotum much narrower than the head, broader than long, anterior border straight; sides and posterior margin convex; front angles blunt, hind ones considerably rounded off; a narrow, pale yellow median line, inner halves of the lateral fields with pale sculpturings, meso- and metanotum similarly marked. The entire venter of the thorax pale yellow. Legs pale yellow, except for the dorsal aspects of the trochanters, coxae and femora which are brown; thick fringes of long, fine hair along the outer edges of the femora and tibiae. Four pairs of tracheal gills in the form of slender, finger-like, blind sacs situated as follows; one small pair far apart on the base of the submentum, the second pair, which is also small, on the latero-anterior border of the base of the front legs, the third and fourth pairs on the latero-anterior sub-marginal areas of the meso- and metasternum on a line with the inner borders of the base of the middle and hind legs (fig. 46).

Abdomen brown above, yellow below. Setae pale yellow, each articulation surrounded by a whorl of short, stout, brown hairs, a thick fringe of long, fine hairs along the mid-dorsal line of each seta. The posterior border of the tenth tergite slightly produced; the supra-anal plate, a fleshy lobe attached to the ventral side of the posterior border of the last tergite (fig. 47, Sup. A. P.); sub-anal plates, triangular (fig. 47, Sub. A. P.).

The general form and coloration of these nymphs indicates that they belong in this tribe, and since they agree with the adult *Megarcys signata* in size, number, and location of the gills, I am placing them in that species tentatively.

Six immature specimens from Goat Creek, Ashford, Washington, (Miss Hortense Butler), XI, 12, 1905, in the entomological collection at Cornell University, Ithaca, New York.

**ARCYNOPTERYX** Klapálek

1904. *Arcynopteryx* Klapálek, Bull. Intern. Acad. Scien. Bohême, no. 17: 7.
1912. *Arcynopteryx* Klapálek, Coll. Selys, 4: 13.

In making a general statement concerning this genus, Klapálek says that it is closely related in the character of the venation to *Perlodes* Banks, but is totally different from it in the structure of the genitalia. In the American species the apical network of cross-veins is irregular and restricted to the anterior part of the wing, it extends chiefly between costa and the branches of the radial sector; the costal margin shows a slight concavity at the humeral cross-vein; with the exception of *Arcynopteryx aurea*, at least the first third (often considerably more) of the area beyond the humeral cross-vein free from cross-veins; except in *Arcynopteryx vagans* and *aurea* subcosta passes into radius before the level of the cord; the length of the inner, inter-radial cell at least twice as great as its base.

In the male the ninth sternite forms a subgenital plate; the tenth tergite is bifid, the posterior inner margin of each lobe is prolonged into an appendage-like process which is directed dorsalward; the supra-anal plate consists of a pair of para-genital plates, and median and lateral stylets. In *Arcynopteryx vagans*, the only species of which we have a male, the para-genital plates are the only parts that are visible without dissection.

Adults of some species of this genus are gill-bearing.

With one exception, the new species which I am including in this genus are based on venational characters and are represented only by females.

*Key to Species of Arcynopteryx*[6]

Adults

a. Without tracheal gills.
  b. An apical network of cross-veins in the area between costa and the branches of the radial sector . . . . . **inornata**
  bb. An apical network of cross-veins in the area between costa and media. **ignota**

[6] *Arcynopteryx minor* Klapálek, from Arctic America, is omitted in this key, since it is unknown to me and since Klapálek does not figure it.

aa. With tracheal gills.

b. With five pairs of gills.

c. A little less than the first half of the costal area beyond the humeral cross-vein free from cross-veins; the upper branches of the radial sector forked ..... **vagans**

cc. Only a small costal area beyond the humeral cross-vein free from cross-veins; the upper branches of the radial sector not distinctly forked, but merged with the network of cross-veins ..... **aurea**

bb. With two pairs of gills.

c. Female vulvar lamina trapezoidal, with a shallow, U-shaped, apical notch ..... ♀ **lineata**

cc. Female vulvar lamina truncate, scarcely produced beyond the border of the eighth segment but cut off from it by oblique corners. ♀ **americana**

**Arcynopteryx lineata** new species

Adult

*Distribution.*—Old Forge, New York.

♀.—Length to tip of wings, 22 mm.; expanse of wings, 34 mm.; length of antennae, 9 mm.; length of setae, 11 mm.

Color dark brown varied with yellow, pubescent. Head with three small ocelli arranged in an isosceles triangle, the lateral ocelli equidistant from each other and the inner margin of the eyes, the distance between them a third greater than the side of the triangle. On either side of the ocellar triangle, a little closer to the lateral ocellus than to the inner margin of the eyes, is a rather flat, elliptical tubercle. M-shaped mark fairly prominent. Head, yellowish-brown, a blackish-brown, rectangular, frontal spot with short horns extending posteriorly to the paired ocelli; entire occipital border yellow with a broad, median, triangular extension passing forward with its apex in the apex of the ocellar triangle; anterior to the yellow border, a dark brown coarsely sculptured oval area on the lateral occipital regions. Under side of head yellowish, palpi and antennae brown.

Prothorax quadrangular, wider than the occiput, breadth almost twice as great as the width, front and hind margins a little convex, sides straight, angles rounded; a broad, median, yellow stripe, inner lateral fields with glossy corrugations. Meso- and metanotum dark brown. Venter of thorax pale with a large, brown, median, shield-shaped spot on each of the three segments, on the anterior border of the last two segments, transverse bands running out from the median spots. Legs dark brown with femora and upper part of tibiae a little paler in coloration. Wings with yellow-brown venation, an irregular network of cross-veins between costa and the branches of the radial sector; nearly the first half of the costal area beyond the humeral cross-vein free from cross-veins; the length of the inner inter-radial cell three times as great as its base. A single pair of small, white, fleshy, finger-like gills on the lateral margins of the submentum.

*Female.* Abdomen uniformly dark brown; basal segments of the setae brown, the following ones alternately ringed with white and brown, each segment being marked with a narrow, basal, ring of white followed by first a narrow brown, then a narrow white band and finally a broad, brown, terminal ring. Vulvar lamina trapezoidal with a broad, shallow, V-shaped, apical notch (fig. 48).

One female specimen from Old Forge, New York, VIII, 16, 1905, (J. G. Needham), in the collection at Cornell University, Ithaca, N. Y., is the type of this species.

Male unknown.

Nymph unknown.

**Arcynopteryx aurea** new species

Adult

*Distribution.*—California.

♀.—Length to tip of wings, 21 mm.; expanse of wings, 32 mm.

This species is apparently rather closely related to *Arcynopteryx vagans*. It is yellowish-brown with yellow markings. Head triangular, three small ocelli arranged in an isosceles triangle the base of which is greater than the sides, the distance from the inner margin of the eyes to the posterior ocelli less than the distance between the posterior ocelli, but greater than that from them to the anterior ocellus. Outside the ocellar triangle, conspicuous, dark brown tubercles situated a little nearer the paired ocelli than the inner margin of the eyes. M-shaped mark prominent. The anterior region of the head uniform yellowish brown, the occiput with three pale yellow spots, a small median triangular one with larger oval ones on either side. Under side of head, pale, palpi brown.

Pronotum quadrangular, wider than the occiput and a little wider than long, only slightly narrowed posteriorly, sides straight, anterior border markedly convex, posterior one a trifle arcuated, anterior angles rather sharp, posterior ones rounded; a broad median yellow stripe, lateral fields embossed. A similar, broad median stripe on the mesonotum, and a small median marginal spot on the anterior border of the metanotum. Venter of thorax pale with a median shield-shaped darker marking on each of the three segments, from these dark median spots on the last two segments, transverse extensions run out laterally just anterior to the base of the legs. Legs yellowish-brown, bases and tips of femora and tibiae, and tarsi, dark brown. Tips of wings broadly rounded, venation pale brown; a rich irregular network of cross-veins between costa and the anterior branches of the sector, in the fore-wing there is not a long costal area beyond the humeral cross-vein that is free from cross-veins, subcosta passes into radius slightly beyond the level of the cord, the length of the inner inter-radial cell twice as great as its base, first anal vein forked (fig. 64). Five pairs of long, white, slender, fleshy, finger-like tracheal gills arranged as in *Arcynopteryx vagans*, one pair widely separated on the base of the submentum, a second pair on a line with the first in the articulation between head and thorax,

the third pair, a little lateral and anterior to the base of the fore legs, the fourth and fifth pairs in the same relative position on the meso- and metathorax.

*Female.* Abdomen brown above and below; vulvar lamina paler, large and shining, produced nearly across segment nine; the posterior border in the form of a W with rounded angles (fig. 49).

Described from a single type specimen from California. This is in the entomological collection at Cornell University, Ithaca, New York.

Male unknown.

Nymph unknown.

**Arcynopteryx vagans** new species

Adult

*Distribution.*—Nevada County and San Diego, California.

♂.—Long-winged. Length to tip of wings, 16 mm.; expanse of wings, 26 mm.

♂.—Short-winged. Length to tip of wings, 14 mm.; expanse of wings, 21 mm.

♂.—Length of antennae, 16 mm.; length of setae, 11 mm.

Yellowish-brown varied with yellow markings on the head and thorax, and paler beneath. Head triangularly produced; three small ocelli placed in an isosceles triangle, its base greater than the sides, the distance from the inner margin of the eye to the posterior ocellus greater than the side of the triangle but not as great as the base. On either side of the ocellar triangle, a glossy, dark brown, oval tubercle, somewhat nearer the posterior ocellus than the inner margin of the eye. M-shaped mark conspicuous. Labrum whitish. From the tubercle a broad, dark fuscous area extending laterally to the eye and encircling its inner margin with a narrow band which spreads out posteriorly, covering the entire occipital region behind the eye, anteriorly the band broadens and runs along the lateral border of the frons and clypeus. In one specimen at the level of the anterior ocellus, a transverse bar connecting the dark areas of either side, in the same specimen, from the tubercle a posterior extension, running slightly diagonally inward to the occipital margin. Three pale yellow, coarsely corrugated spots on the posterior border of the occiput, a small median triangular one with its apex directed forward, and on either side close to the dark fuscous areas behind the eyes, a large oval spot. Antennae brown, stout, as long as the body; palpi brown; under side of head, pale.

Pronotum trapezoidal, anterior border wider than the posterior and wider than the occiput, sides and posterior margin straight, anterior margin convex, front angles rather sharp, hind angles rounded off; a broad, median, yellow stripe, conspicuous, glossy brown, embossed markings on the lateral fields. Meso- and metanotum dark brown with the median yellow band of the pronotum continued upon them. The entire venter of the prothorax pale with darker markings. Legs yellowish-brown; bases and tips of femora and tibiae,

and tip of tarsi, ringed with dark brown. Wings with fine yellowish-brown venation, an irregular network of cross-veins occupying the tip of the wing in the region between radius and the anterior branches of the sector; a little less than the first half of the costal area beyond the humeral cross-vein free from cross-veins; subcosta runs into radius beyond the level of the cord; the length of the inner inter-radial cell twice as great as its base (fig. 63).

Both long and short winged males, in the latter the wings are not greatly shortened, they extend to the tip of the abdomen. Five pairs of long, white, slender, fleshy, finger-like, tracheal gills arranged as follows; one pair widely separated on the base of the submentum, a second pair on a line with the first in the articulation between head and thorax, the third pair a little lateral and anterior to the base of the fore legs, the fourth pair on the anterior border of the mesothorax on a line with the base of the legs, and the last pair in the same relative position on the metathorax.

*Male.* Abdomen dark brown above and on the sides, pale on the venter. Setae about three-fourths the length of the body; pale brown, conspicuously ringed with darker and provided with whorls of fine bristle-like hairs toward the tip of the segments. The seventh dorsal segment triangularly produced over the eighth, and ending in a strong, upright median fork; the eighth segment, normal; the ninth entire, narrow above, elongated below into a conspicuous subgenital plate marked with fine transverse striae, a median villous area set off from the lateral parts by prominent carinae. The tenth segment concealed by the ninth on the venter; widely cleft above, each lobe with an erect appendage-like process on the inner posterior margin; sub-anal plates boat-shaped, flaring; stylets entirely concealed by the para-genitals which appear between the posterior border of the tenth tergite and the sub-anals, as a pair of lateral chitinous sheaths with a white, membranous median portion (fig. 51).

In the entomological collection at Cornell University there are three male specimens, two (alcoholic) from San Diego, California, IV, 23, 1879, and one from Nevada County, California (C. V. Riley collector). One of the specimens from San Diego is the type of this species.

Female unknown.

Nymph unknown.

**Arcynopteryx ignota** new species

Adult

♀.—Length to tip of wings, 17 mm.; expanse of wings, 29 mm.; length of setae, over 11 mm. (those on the specimen measure 11 mm. but they are broken).

Dark brown, with a few paler markings. Head triangularly produced; three moderately large ocelli arranged in an isosceles triangle, the base of which is greater than the sides, but less than the distance from the posterior ocelli to the inner margin of the eyes; the M-shaped mark present but not prominent,

small, round, inconspicuous tubercles situated nearer the posterior ocelli than the inner margin of the eyes. The lateral borders of the clypeus pale yellow; a dark fuscous crown spot in the form of a letter X with its center in the median ocellus, the anterior part outlining the middle region of the M and the posterior part extending back to the lateral ocelli; a median, deep yellow, occipital spot reaching forward between the ocelli; dark brown, coarsely sculptured, oval-shaped spots on the lateral occipital areas. Antennae brown, the basal segment the darkest; under side of head pale, palpi dark brown.

Pronotum rectangular, not as broad as the head; sides straight, front and hind margins convex, angles blunt; a yellow median band, broader behind; the inner regions of the lateral fields with embossed markings. Meso- and metanotum and the entire venter of the thorax, with the exception of narrow areas surrounding the bases of the legs which are paler, dark brown. Legs brown except a pale band before the knees and pale tibiae. Wings with yellow-brown venation, except basal portions of costa and sub-costa in fore-wing and all bases in hind wing which are yellow; an irregular network of cross-veins extending from costa through the anterior branches of the sector, the network richest between $radius_1$ and $radius_2$, over the first half of the costal area beyond the humeral cross-vein free from cross-veins; the length of the inner inter-radial cell twice as great as its base. Without gills.

*Female.* Abdomen uniformly dark brown, setae long and slender; alternately ringed with dark brown and white, except for the first few basal segments, which have but a single ring of dark and light, each segment is marked with a white basal band followed first by a narrow brown, then a narrow white ring, and finally a broad brown one. The eighth ventral segment produced somewhat triangularly with a rectangular notch in the tip. Sub-anal plates, large, triangular (fig. 52).

Described from a single specimen, the type, without locality label, in the collection of the Academy of Natural Sciences of Philadelphia.

Male unknown.

Nymph unknown.

**Arcynopteryx inornata** new species

Adult

♀.—Length to tip of wings, 17 mm.; expanse of wings, 30 mm.

Of an almost uniform dark brown coloration. Head rather triangular, so perfectly concolorous that the M-shaped mark, ocelli and tubercles are scarcely visible; palpi and under side of head also dark brown; basal segment of antennae dark brown, succeeding segments slightly paler.

Pronotum trapezoidal, a little broader posteriorly, and the anterior border a trifle wider than the occiput, sides straight, front and hind margins slightly arcuated, angles squarish; a broad, median, yellow band, lateral fields with a few coarse embossings. Meso- and metanotum, dark brown, also the entire venter of the thorax, except for small, pale areas around the bases of the legs. Legs yellowish brown.

Wings with fine yellow-brown venation, an irregular, scanty network in the tip between costa and the anterior branches of the radial sector; at least the first half of the costal area beyond the humeral cross-vein free from cross-veins; in the fore wing the length of the inner inter-radial cell twice as great as its base and cross-veins between media and cubitus$_1$, and cubitus$_1$ and cubitus$_2$, few (fig. 62). Without gills.

*Female.* Abdomen dark brown above and below. Setae long, slender; the first few segments yellowish, the rest, ringed with darker toward the tips. The vulvar lamina large, reaching nearly to the posterior border of the ninth segment, it is in the form of a wide truncate triangle with a broad, shallow, rounded notch in the tip (fig. 53).

Type specimen, of unknown locality, in the collection of Academy of Natural Sciences of Philadelphia.

Male unknown.

Nymph unknown.

**Arcynopteryx americana** Klapálek

1912. *Arcynopteryx americana* Klapálek, Coll. Selys, 4: 21.

Adult

*Distribution.*—Colorado (Klapálek), Wyoming.

♂.—Length of body, 13 mm. (Klapálek).

♀.—Length to tip of wings, 22 mm.; expanse of wings, 34 to 36 mm.; length of antennae, 12 mm.; length of setae, 11 mm.

The following description of the coloration of the male is translated from Klapálek:

"In the male the entire occiput is ochre-yellow and this color extends in a narrow band along the inner margin of the eyes and joins in the middle the spot between the ocelli; the frons, with the exception of ochre-yellow tubercles and small yellow spots outside the posterior ocelli, is dark brown almost to the M line which is also ochre-yellow, then it passes again anteriorly into the dark anterior border of the clypeus. The under side of head is ochre-yellow. The middle field of the pronotum bright ochre-yellow, the sides brown, somewhat brighter toward the inside and darker outside. Meso- and metanotum shining dark brown, the middle parts of the praescutum and scutellum ochre-yellow; on either side a lighter band extending from the praescutum to the base of the wings. Abdomen brown on the dorsum, the entire venter reddish yellow-brown. Antennae brown, paler on the under side, but the first segment dark brown; palpi brown, legs yellow-brown, the outer aspect of the femora with a dark line along the edge, tibiae beyond the knees, and the feet, brown. Setae yellow-brown, indistinctly ringed with darker and sparsely beset with whorls of strong, bristle-like hairs."

The female is chestnut brown with yellow markings, paler beneath. Head dark brown, tubercles and M-line yellow; labrum and anterior corners of clypeus, whitish; posterior border of occiput broadly banded with yellow with a median extension running forward into the posterior half of the ocellar triangle; lateral occipital regions with a coarsely corrugated, oval-shaped spot just anterior to the yellow border. Antennae chestnut brown, a little over half the

length of the body. Palpi pale brown; under side of head whitish except lateral borders of mentum which are brown. Meso- and metanotum dark brown with a narrow, yellow median line on the anterior border; the entire thorax pale beneath with a median, dark brown, shield-shaped spot between the base of the legs, on each side of the three segments, and just anterior to the median spots a dark brown, transverse band on meso- and metathorax. Legs yellow brown, femora rather dark, knees pale, darker bands at base and tip of tibiae, and tip of tarsi.

Ocelli small, arranged in an isosceles triangle, the base of which is almost half again as great as the sides, the distance from the inner margin of the eye to the posterior ocelli less than the distance between the anterior and posterior ocelli. On either side of the ocellar triangle a glossy, kidney-shaped tubercle, placed a little nearer the posterior ocelli than the inner margin of the eyes.

Pronotum broader than long, about as wide as the occiput, sides straight, anterior and posterior borders slightly convex, corners blunt; a broad, median yellow band somewhat widened anteriorly and posteriorly, the lateral fields dark with indistinct sculpturings on the inner half. Wings rather short, in the male "the anterior ones reach the posterior border of the seventh segment and the posterior ones, the posterior border of the eighth segment" (Klapálek); in the female they just reach the tip of the abdomen; their color, brown; venation brown, except costa and base of subcosta which are yellowish; a scanty network of cross-veins in the apical part of the wing in the region before media; a little less than the first half of the costal area beyond the humeral cross-vein, free from cross-veins; the length of the inner inter-radial cell three times as great as its base. A single pair of slender, white, finger-like, tracheal gills widely separated on the base of the submentum.

*Male.* Klapálek says that *Arcynopteryx americana* is normally developed and that there is no departure from the generic type (fig. 54).

*Female.* Abdomen dark brown above and on the sides, pale on the venter. Setae slender, tapering, about half as long as the body; alternately yellow and dark brown, the apical half of the segment being the darker. The subgenital plate, truncate, about three-quarters as wide as the segment, scarcely produced beyond the margin of the segment but distinctly marked off from it by dark brown, oblique corners, or, in one specimen, slightly rounded corners. The tenth tergite triangularly produced; the supra-anal plate a fleshy rounded lobe attached to the ventral surface of the tenth tergite; the sub-anal plates triangular, broadly divergent (fig. 55).

We have two female specimens, one bearing simply the label, Wyoming, and the other (which has a more nearly dark brown general coloration than chestnut brown) from Little Laramie River, Hatton, Wyoming, V, 25, 1912.

Nymph unknown.

**Arcynopteryx minor** Klapálek

1912. *Arcynopteryx minor* Klapálek, Coll. Selys, 4: 22.

*Distribution.*—Arctic America.

♂.—Length of body, 11 mm.; ♀, 13 mm.; length of anterior wing of ♀ 14 mm.

"Anterior part of the body almost black, abdomen blackish brown, in the female yellowish spots on the venter. In the male the small crown-spot of the head joins the occipital bands and widens laterally along the crown suture; the sides of the clypeus are yellow-brown. In the female the occipital bands are indistinct, the crown-spot greatly reduced, but the sides of the clypeus are prominently bordered with yellow-brown. In the male the middle band of the pronotum occupies the entire middle field; in the female it is less conspicuous, but the lateral portions show light areas. The under side of the head is yellow-brown with a black-brown throat; otherwise the under side is black-brown, the venter of the female is lighter. Antennae black-brown, palpi dark brown. Legs dark brown, femora narrowly bordered with yellow-brown on the ventral edge, and broadly on the dorsal; tibiae yellow-brown for the most part. Setae shining bright brown.

"Head not as long as usual in the species of this genus and a little narrowed anteriorly. Eyes moderately large and spherically rounded, behind them there are short tempora. Ocelli small, forming an isosceles triangle; the distance between the posterior ocelli is more than half longer than the distance from the inner margin of the eyes and from the anterior ocellus (30: 20: 22). The crown suture distinct, the occipital furrow deep. Tubercles large, broadly oval, equally distant from the posterior ocelli and the inner margin of the eyes. The cuticle is fine, but with prominent reticulate wrinkles, and outside the tubercles and the M-shaped mark it is studded with scattered pits bearing bristles.

"Pronotum slightly trapezoidal, narrower in front than the occiput, a little widened posteriorly (50: 53: 47). Anterior and posterior borders broad, convex; sides straight. Middle furrow narrow but deep; the middle area very broad, occupying in the first third almost a fifth of the entire breadth, widened anteriorly and posteriorly. The structure is similar to that of the head.

"In the male the wings are greatly shortened, so that the anterior ones reach the posterior border of the second segment, and the posterior ones the posterior border of the third segment. In both sexes they are conspicuously smoked. The network in the tip of the wing occupies the space between radius, its sector, and the several branches of the same; but it is comparatively simple and composed of large, not very irregular cells. The inner inter-radial cell of the fore wing is a little more than once and a half as long as its base.

"In the male the ninth segment is prolonged into a yellow-brown, parabolic, subgenital plate, the tenth segment is cleft on the dorsal side with mallet-like processes. The other parts show no departure from the usual form.

"The female subgenital plate is short, semicircular, bright brown, and does not appear notched on the posterior margin.

"A pair in the collection of the Museum of London.

"This species is certainly very near *Arcynopteryx compacta* Mac Lachlan, but is distinguished by its darker color and smaller body." Translation from Klapálek.

Unknown to us.

Nymph unknown.

**Arcynopteryx** nymph—**"b"**

Immature nymph. Length to tip of abdomen, 22 mm.; length of antennae, 12 mm.

*Distribution.*—Las Vegas, New Mexico.

Color, yellowish brown, varied with paler markings. Head squarish, three small ocelli placed in an isosceles triangle, the base of which is about a third greater than sides, and equal to the distance between the inner margin of the eyes and the paired ocelli. Tubercles pale yellow, kidney-shaped; the M-shaped mark prominent, also pale yellow; a small median triangular pale spot confluent with the middle portion of the M; labrum and anterior border of the clypeus, white; pale yellow, oval-shaped spots on the lateral occipital areas; a faint indication of a median, occipital, triangular yellow spot reaching forward between the ocelli. Under side of head, palpi and antennae, pale yellow.

Pronotum as broad as the occiput, nearly twice as wide as long, sides and both margins convex, angles rounded; a narrow, median, pale line, lateral margins bordered with pale yellow, the inner halves of the lateral fields with pale sculpturings, the meso- and metanotum with similar markings. The entire venter of the thorax pale yellow. Legs also pale yellow. The outer margins of the femora and tibiae with thin fringes of long, fine, silky hairs. A single pair of finger-like tracheal gills placed far apart on the base of the submentum.

Abdomen brownish-yellow above, with three rows (a median one and on either side of it, a lateral one) of pale yellow spots, the spots on the last few segments are most conspicuous. The entire venter of abdomen and basal segments of the setae (all that remains of them) pale yellow. The tenth tergite triangularly produced; the supra-anal plate (fig. 57, Sup. A. P.) a rather large, fleshy lobe attached to the apical border of the last tergite; the sub-anal plates, (fig. 57, Sub. A. P.), triangular.

I am placing nymph "B" in the genus *Arcynopteryx* since it possesses a single pair of gills of the same form and in the same location in which they occur in two species of the adults of the genus.

Described from a single specimen from Las Vegas Hot Springs, New Mexico (T. D. A. Cockerell).

We have two other very young nymphs with a similar arrangement of gills but with different color patterns. They are too

immature, however, to warrant anything but mentioning. One of them is from Boulder, Colorado (T. D. A. Cockerell), X, 1905, and the other from Goat Creek, Ashford, Washington (Miss Hortense Butler), XI, 12, 1905. All of these specimens are at Cornell University, Ithaca, New York.

### **DICTYOGENUS** Klapálek

1904. *Dictyogenus* Klapálek, Rozpr. Čes. Akad., 13, č. 17, p. 7.
1904. *Dictyogenus* Klapálek, Bull. Intern. Acad. Sci. Boheme, p. 7.
1912. *Dictyogenus* Klapálek, Coll. Selys, 4: 48.
"*Dictyopteryx* Pictet, Ris et auct. partim." Klapálek.

Klapálek characterizes this sub-genus as follows: "A more or less regular network of cross-veins in the tip of the wings; the distance between the posterior ocelli and the inner margin of the eyes at least two-thirds of the distance between them."

We have a single female specimen unlike any of the other species of the tribe in venation and coloration, which I am placing here as a possible member of the genus. The striking coloration, yellowish spotted with black, agrees well with that of some of the European species and the venation is like that of the European ones in so far as it is stated.

**Dictyogenus? phaleratus** Needham, new species

Adult

*Distribution.*—New Mexico.

"Length from head to base of cerci, 11.9 mm.; forewing, 14.5 mm.; hind wing, 12.8 mm.

"Color yellowish, phalerate with black; a broad, black triangle on frons, with apex rear; a large black four rayed spot on top of head, U-shaped in front, the hollow of the U surrounding the rear point of the frontal triangle, anterior rays running outward and backward to the eyes, posterior rays over-spreading the paired ocelli. Balance of head yellow, excepting two vertical tubercles and two smaller black, shining spots at lateral angles of frontal triangle.

"Prothorax quadrate, nearly twice as broad as long, with broad yellow median stripe divided with black on the middle suture and bordered outside by an obscure line of blackish, embossed markings; a few larger embossed markings farther out, half way to the lateral margin. Thorax broadly lined with black on all sutures. Legs, lineate with black on all carinae with a sharp transverse band at each joint and a diffuse one a little above each knee joint.

"Abdomen blackish on sides, yellowish beneath, with interrupted transverse rows of black dots across the middle of the segments." Quoted from Prof. Needham's manuscript.

In this species wings rather long and narrow; a scanty irregular, apical network of cross-veins occupying the region between the branches of the sector and media; the costal margin not showing a concavity at the humeral cross-vein; the entire costal area beyond the humeral cross-vein occupied by numerous cross-veins; subcosta passes into radius before the level of the cord, the length of the inner inter-radial cell only a fourth greater than its base; cord well developed; the first anal vein not angled at the base as in all other species of this tribe (fig. 65). Without gills.

*Female.* The posterior margin of the eighth ventral segment is evenly produced forming a short, broad, hemispherical vulvar lamina (fig. 56).

One female specimen from New Mexico and another from Florissant, Colorado, VI, 1907 (T. D. A. Cockerell). The specimen from New Mexico is the type of this species. It is at Cornell University in the entomological collection.

*Abbreviations*

Sub. A. P. Sub-anal plate.
Sup. A. P. Supra-anal plate, with the following parts:—
C. Sperm cup.
F. Free end.
I. Inner part.
L. Link.
L. B. Lateral brace.
L. S. Lateral stylet.
M. Muscle.
M. S. Median stylet.
P. G. P. Para-genital plate.
P. T. Protractile tendon.
R. T. Retractile tendon.
P. A. P. Para-anal plate.
S. Membranous sac.

## EXPLANATION OF PLATES

Figs. 1–8, 10, 12–15, 20–26, 28–32, 34–36, 39, 41–44, 47–49, 51–57 drawn on the same scale to show relative size.

Figs. 27, 33 and 46 drawn on the same scale to show relative size.

Figs. 16–19, 37 and 38 drawn on the same scale to show relative size.

Figs. 11, 40, 45, 50 and text figures B, D and E drawn on the same scale to show relative size.

The same scale of magnification was not kept for the drawings of the wings (figs. 9, 58–65). Consequently the actual measurement is given in the explanation of each wing figure.

### Plate XXIX

Fig. 1.—*Pteronarcys dorsata* Say. End of abdomen of adult ♂ in left lateral view.

Fig. 2.—*Pteronarcys dorsata* Say. End of abdomen of adult ♀ in ventral view.

Fig. 3.—*Pteronarcys nobilis* Hagen. End of abdomen of adult ♂ in left lateral view.

Fig. 4.—*Pteronarcys nobilis* Hagen. End of abdomen of adult ♀ in ventral view.

Fig. 5.—*Pteronarcys californica* Newport. End of abdomen of adult ♂ in left lateral view.

Fig. 6.—*Pteronarcys californica* Newport. End of abdomen of adult ♀ in ventral view.

Fig. 7.—*Pteronarcys princeps* Banks. End of abdomen of adult ♂ in left lateral view.

Fig. 8.—*Pteronarcys princeps* Banks. End of abdomen of adult ♀ in ventral view.

### Plate XXX

Fig. 9.—*Pteronarcys dorsata* Say. ♀ adult wings. Length of fore-wing, 48 mm.

Fig. 10.—*Pteronarcys biloba* Newman. End of abdomen of adult ♀ in left lateral view.

Fig. 11.—*Pteronarcys proteus* Newman. Entire supra-anal plate of adult ♂ in left lateral view.

Fig. 12.—*Pteronarcys proteus* Newman. End of abdomen of adult ♂ in left lateral view.

Fig. 13.—*Pteronarcys proteus* Newman. End of abdomen of adult ♀ in ventral view.

Fig. 14.—*Pteronarcys biloba* Newman. End of abdomen of adult ♂ in left lateral view.

Fig. 15.—*Pteronarcys comstocki* new species. End of abdomen of adult ♀ in ventral view.

Fig. 16.—*Pteronarcys proteus* Newman. Outline of prothorax of nymph.

Fig. 17.—*Pteronarcys dorsata* Say. Outline of prothorax of nymph.

Fig. 18.—*Pteronarcys biloba* Newman. Outline of prothorax of nymph.

Fig. 19.—*Pteronarcys californica* Newport. Outline of prothorax of nymph.

## Plate XXXI

Fig. 20.—*Pteronarcys dorsata* Say. End of abdomen of ♂ nymph in left lateral view.

Fig. 21.—*Pteronarcys dorsata* Say. End of abdomen of ♀ nymph in left lateral view.

Fig. 22.—*Pteronarcys californica* Newport. End of abdomen of ♂ nymph in left lateral view.

Fig. 23.—*Pteronarcys californica* Newport. End of abdomen of ♀ nymph in left lateral view.

Fig. 24.—*Pteronarcys proteus* Newman. End of abdomen of ♂ nymph in left lateral view.

Fig. 25.—*Pteronarcys proteus* Newman. End of abdomen of ♀ nymph in left lateral view.

Fig. 26.—*Pteronarcys biloba* Newman. End of abdomen of ♀ nymph in left lateral view.

Fig. 27.—Diagram to show arrangement of gills in genus *Pteronarcys*.

Fig. 28.—*Pteronarcella regularis* Hagen. End of abdomen of adult ♂ in dorsal view.

Fig. 29.—*Pteronarcella regularis* Hagen. End of abdomen of adult ♀ in ventral view.

## Plate XXXII

Fig. 30.—*Pteronarcella torosa* new species. End of abdomen of adult ♂ in dorsal view.

Fig. 31.—*Pteronarcella triloba* new species. End of abdomen of adult ♀ in ventral view.

Fig. 32.—*Pteronarcella badia* Hagen. End of abdomen of adult ♀ in ventral view.

Fig. 33.—Diagram to show arrangement of gills in genus *Pteronarcella*.

Fig. 34.—*Pteronarcella torosa* new species. End of abdomen of ♂ nymph in left lateral view.

Fig. 35.—*Pteronarcella torosa* new species. End of abdomen of ♀ nymph in left lateral view.

Fig. 36.—*Pteronarcella* nymph "a". End of abdomen of ♀ in left lateral view.

Fig. 37.—*Pteronarcella torosa* new species. Outline of prothorax of nymph.

Fig. 38.—*Pteronarcella* nymph "a". Outline of prothorax.

Fig. 39.—*Protarcys dolobrata* new species. End of abdomen of adult ♂ in ventral view.

Fig. 40.—*Protarcys bradleyi* new species. Entire supra-anal plate of adult ♂ in left lateral view.

Fig. 41.—*Protarcys bradleyi* new species. End of abdomen of adult ♂ in dorsal view.

Fig. 42.—*Protarcys bradleyi* new species. End of abdomen of adult ♀ in ventral view.

Fig. 43.—*Megarcys signata* Hagen. End of abdomen of adult ♂ in dorsal view.
Fig. 44.—*Megarcys signata* Hagen. End of abdomen of adult ♀ in ventral view.

## Plate XXXIII

Fig. 45.—*Megarcys signata* Hagen. Entire supra-anal plate of adult ♂ in left lateral view.
Fig. 46.—*Megarcys signata* Hagen. Diagram to show arrangement of gills.
Fig. 47.—*Megarcys signata* Hagen. End of abdomen of nymph in left lateral view.
Fig. 48.—*Arcynopteryx lineata* new species. End of abdomen of adult ♀ in ventral view.
Fig. 49.—*Arcynopteryx aurea* new species. End of abdomen of adult ♀ in ventral view.
Fig. 50.—*Arcynopteryx vagans* new species. Entire supra-anal plate of adult ♂ in left lateral view.
Fig. 51.—*Arcynopteryx vagans* new species. End of abdomen of adult ♂ in dorsal view.
Fig. 52.—*Arcynopteryx ignota* new species. End of abdomen of adult ♀ in ventral view.
Fig. 53.—*Arcynopteryx inornata* new species. End of abdomen of adult ♀ in ventral view.
Fig. 54.—*Arcynopteryx americana* Klapálek. End of abdomen of ♂ in dorsal view. After Klapálek.
Fig. 55.—*Arcynopteryx americana* Klapálek. End of abdomen of adult ♀ in ventral view.
Fig. 56.—*Dictyogenus? phaleratus* Needham, new species. End of abdomen of adult ♀ in ventral view.
Fig. 57.—*Arcynopteryx* nymph "b". End of abdomen in left lateral view.

## Plate XXXIV

Fig. 58.—*Pteronarcella regularis* Hagen. ♂ Adult wings. Length of fore-wing, 18 mm.
Fig. 59.—*Protarcys dolobrata* new species. ♀ Adult wings. Length of fore-wing, 21 mm.
Fig. 60.—*Protarcys bradleyi* new species. ♂ Adult wings. Length of fore-wing, 15 mm.
Fig. 61.—*Megarcys signata* Hagen. ♀ Adult wings. Length of fore-wing, 18 mm.
Fig. 62.—*Arcynopteryx inornata* new species. ♀ Adult wings. Length of fore-wing, 13 mm.
Fig. 63.—*Arcynopteryx vagans* new species. ♂ Adult wings. Length of fore-wings, 12 mm.
Fig. 64.—*Arcynopteryx aurea* new species. ♀ Adult wings. Length of fore-wing, 16 mm.
Fig. 65.—*Dictyogenus? phaleratus* Needham, new species. ♀ Adult wings. Length of fore-wing, 15 mm.

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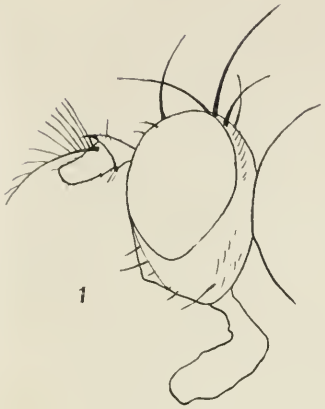
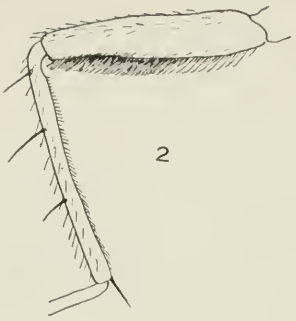
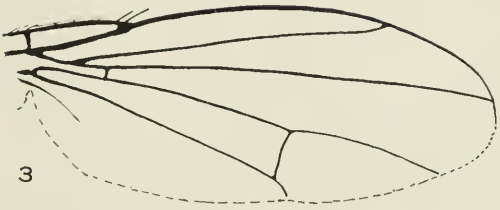
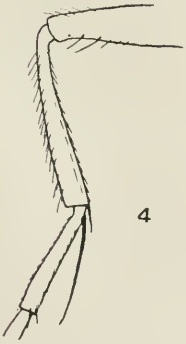
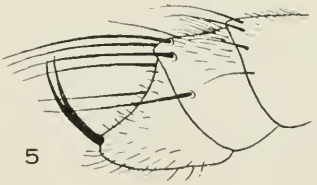
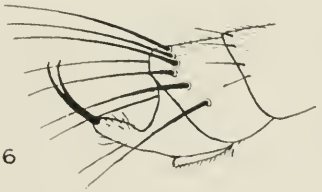


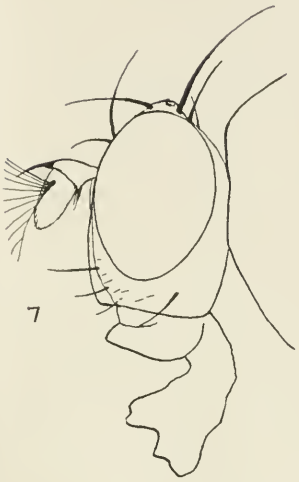




E. T. CRESSON, JR. — AMERICAN EPHYDRIDAE



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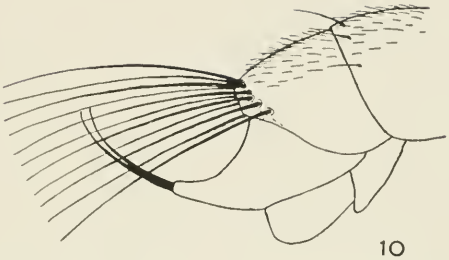

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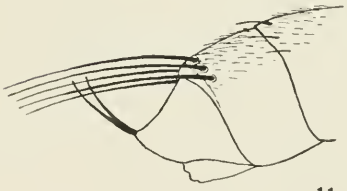

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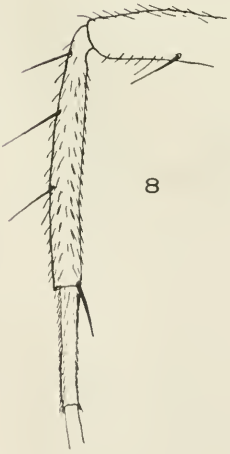

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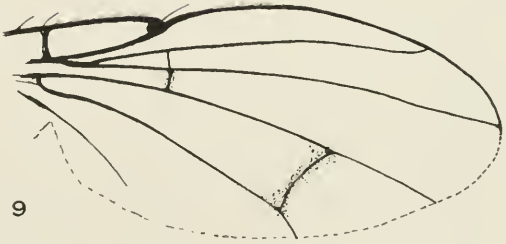

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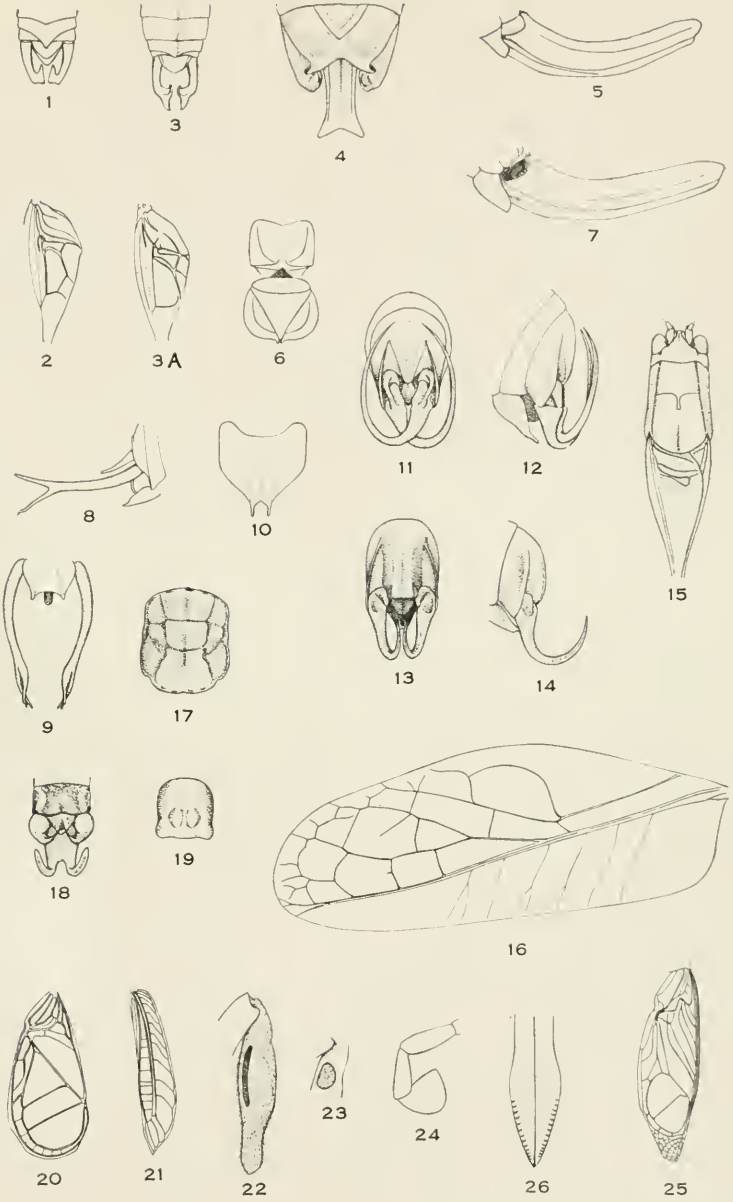
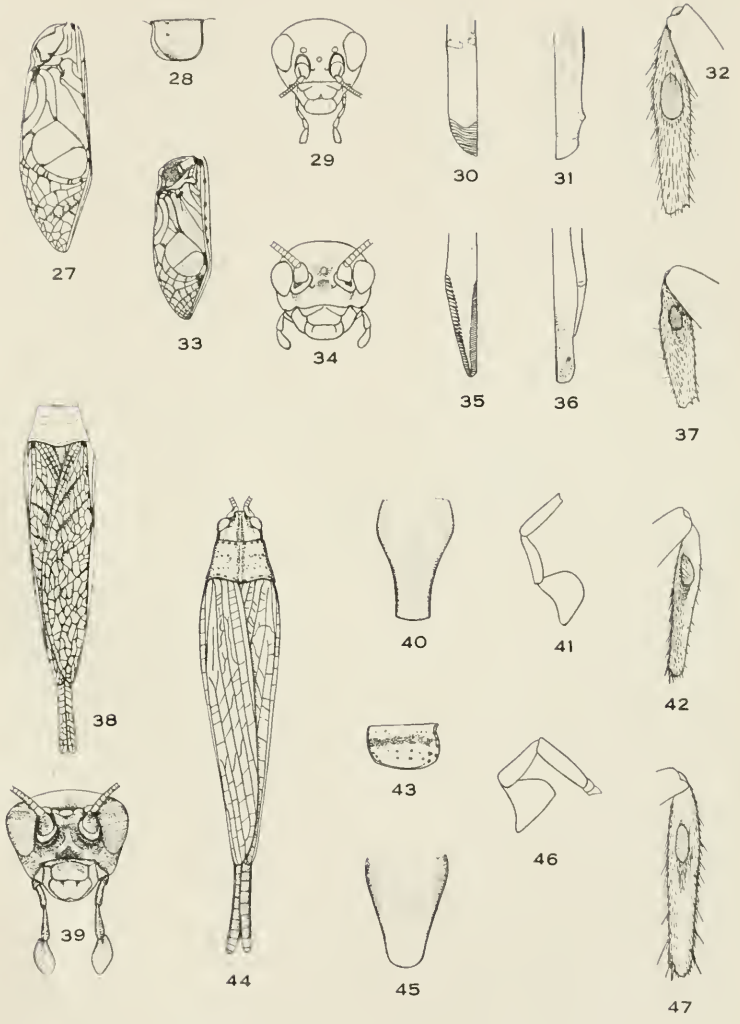



REHN—BRAZILIAN ORTHOPTERA

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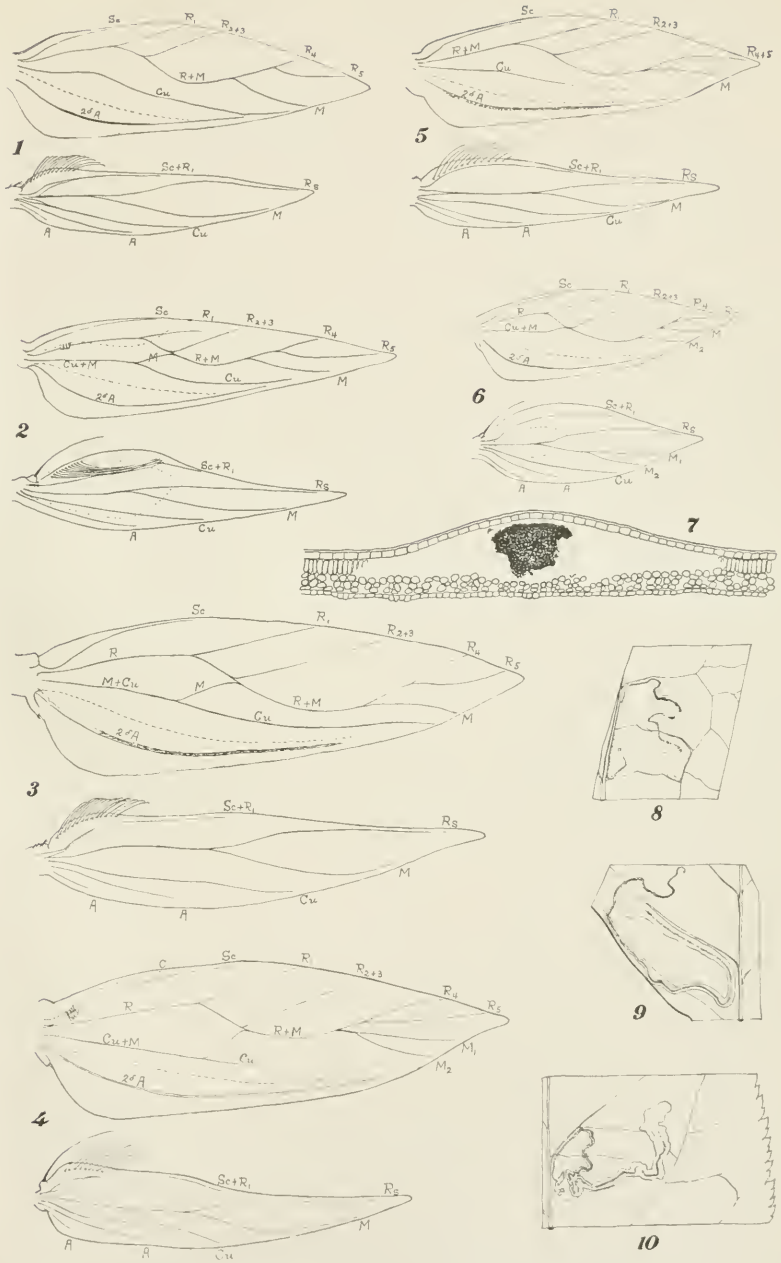
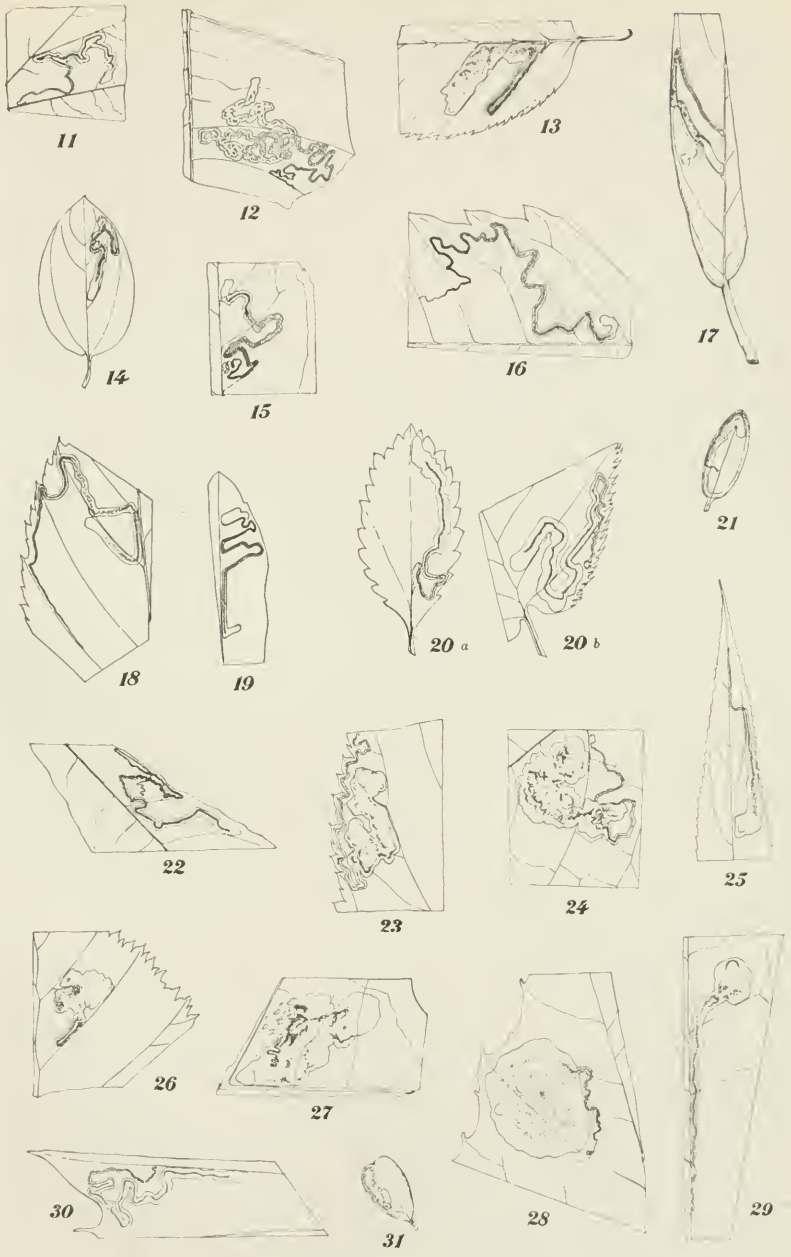



BRAUN — NEPTICULIDAE OF NORTH AMERICA




BRAUN — NEPTICULIDAE OF NORTH AMERICA

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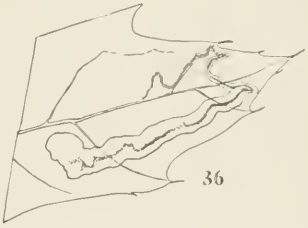
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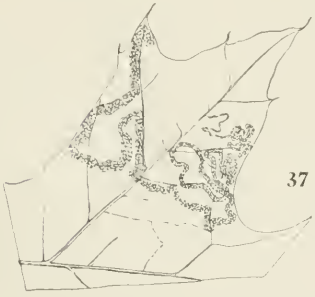
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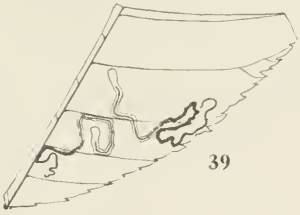
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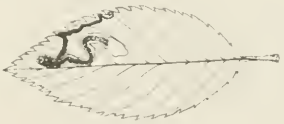
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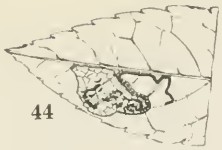

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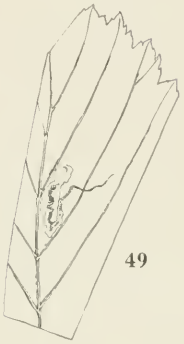

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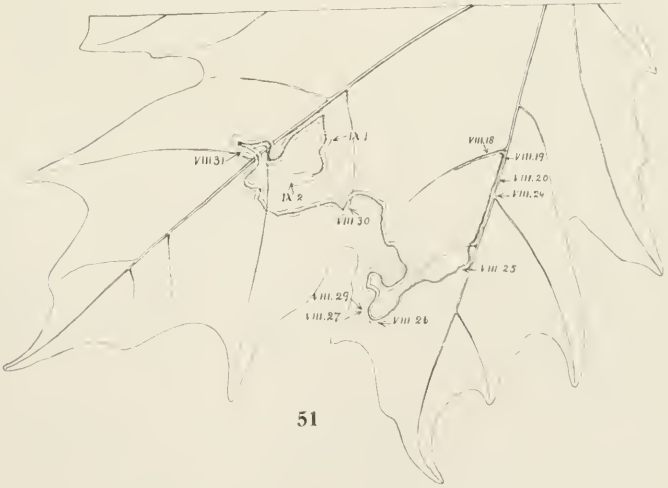


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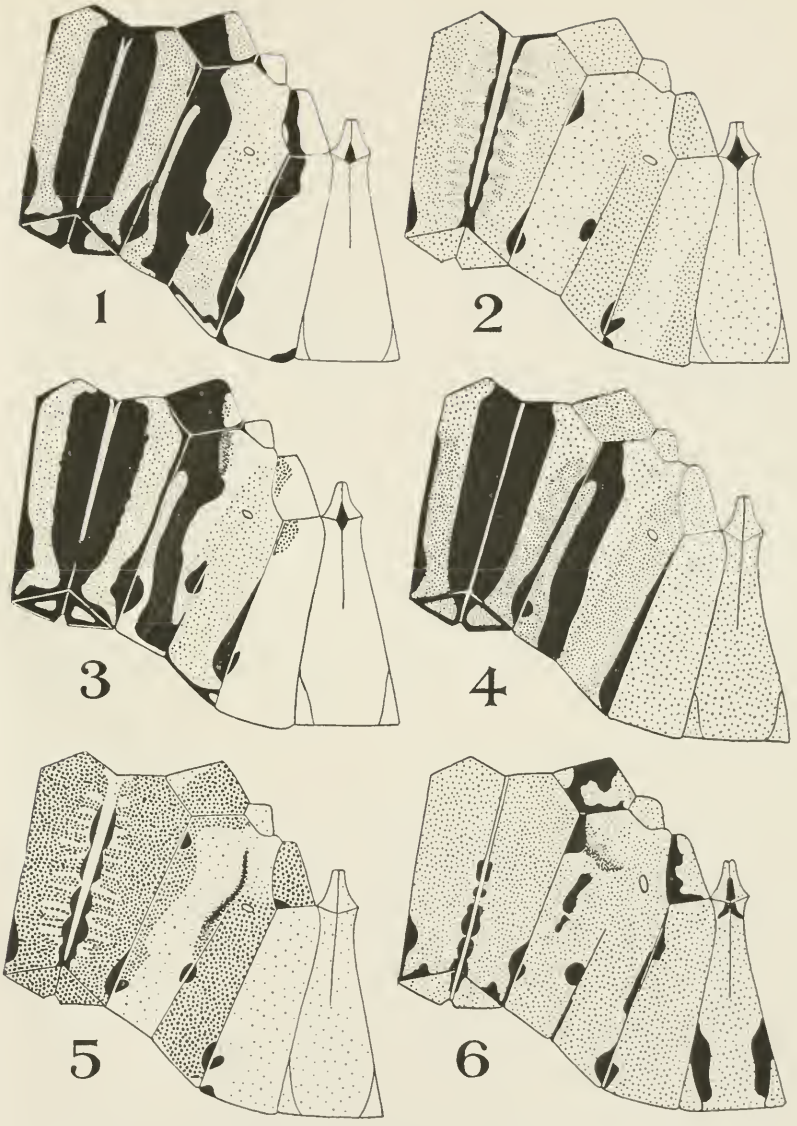
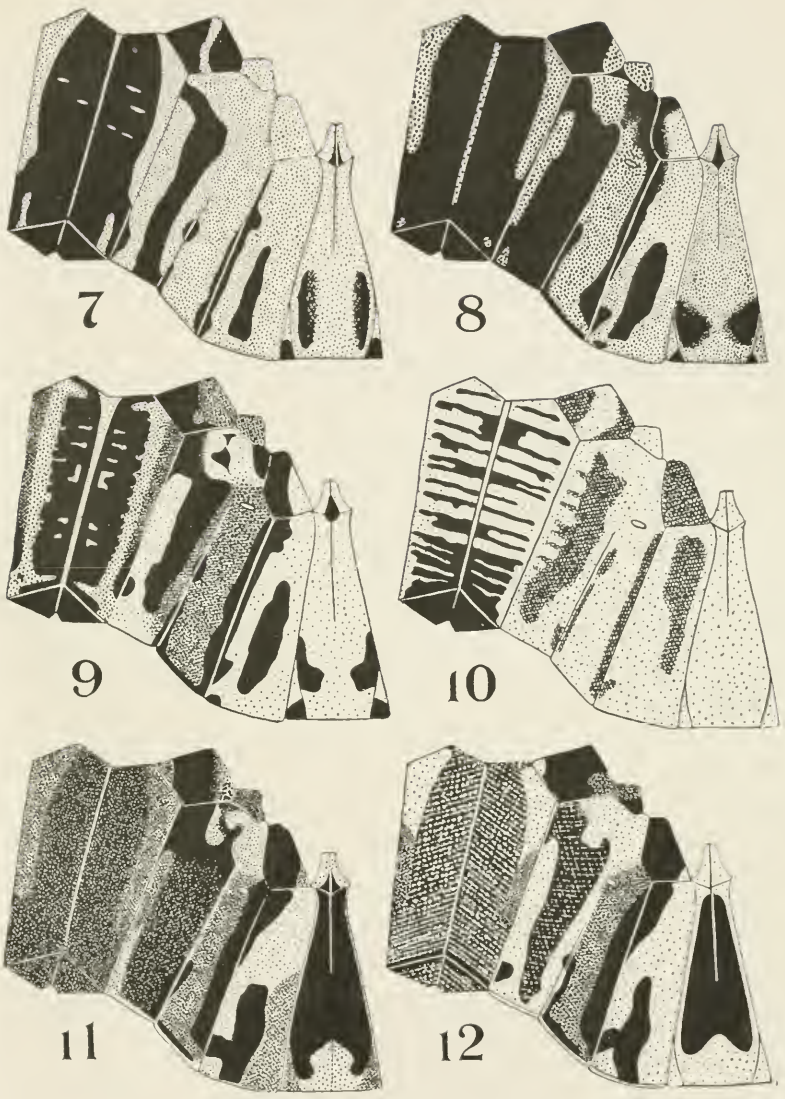
BRAUN — NEPTICULIDAE OF NORTH AMERICA




WILLIAMSON—GENUS NEONEURA

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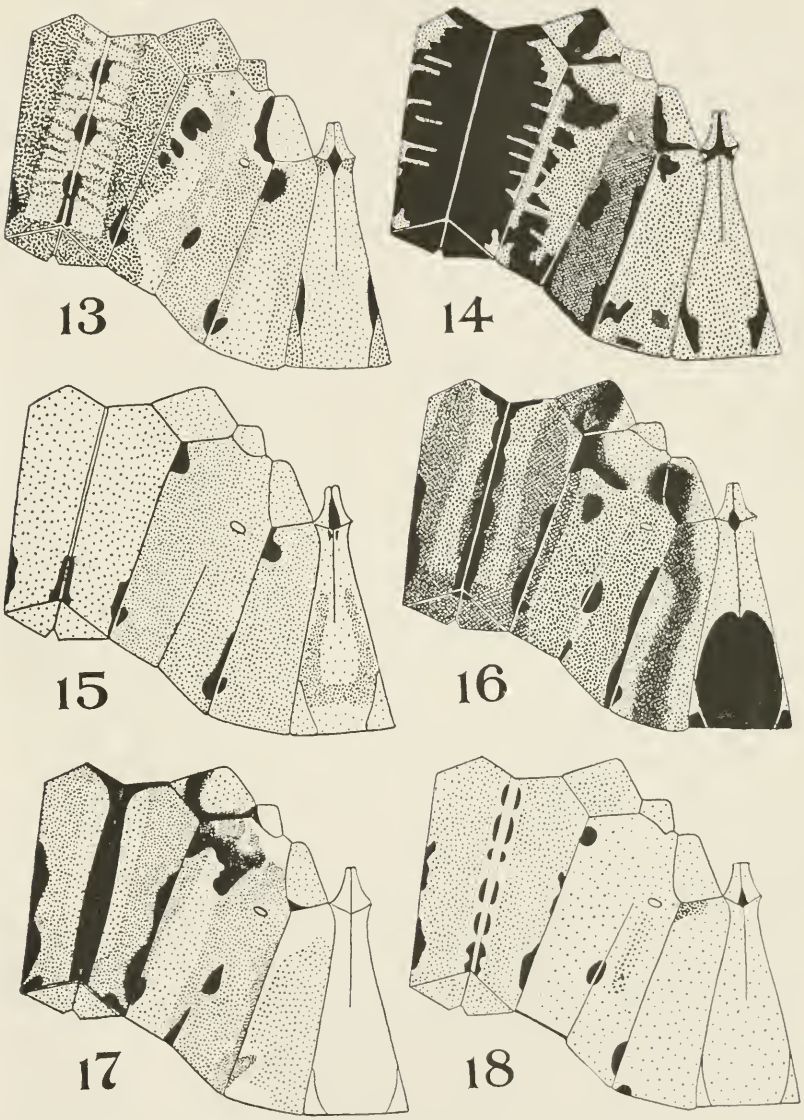


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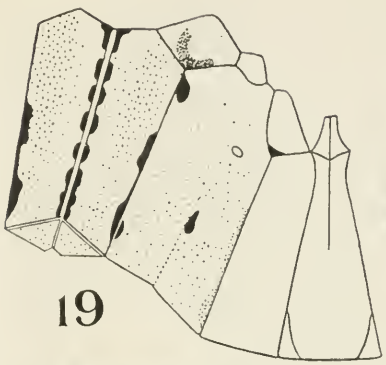


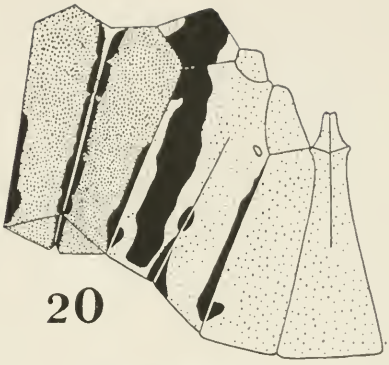


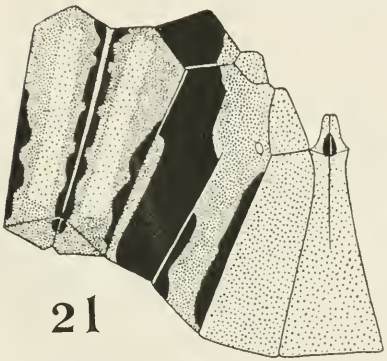


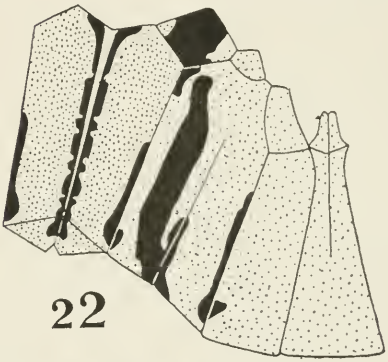


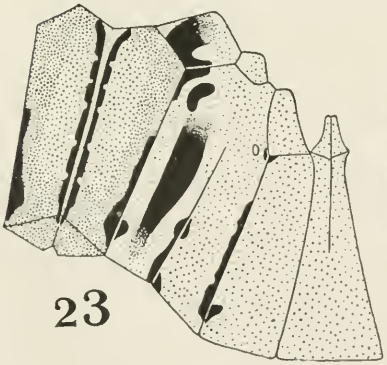


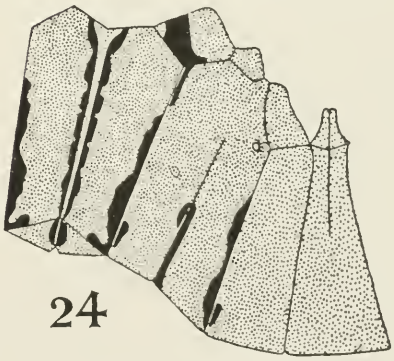


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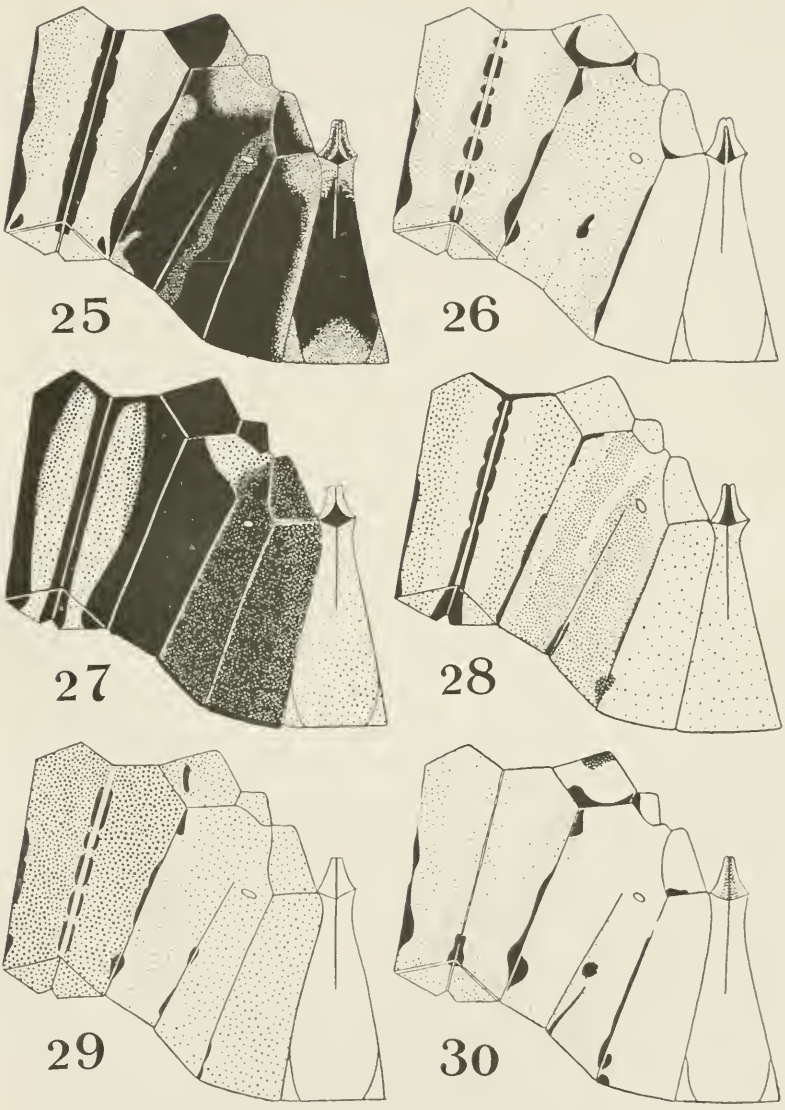


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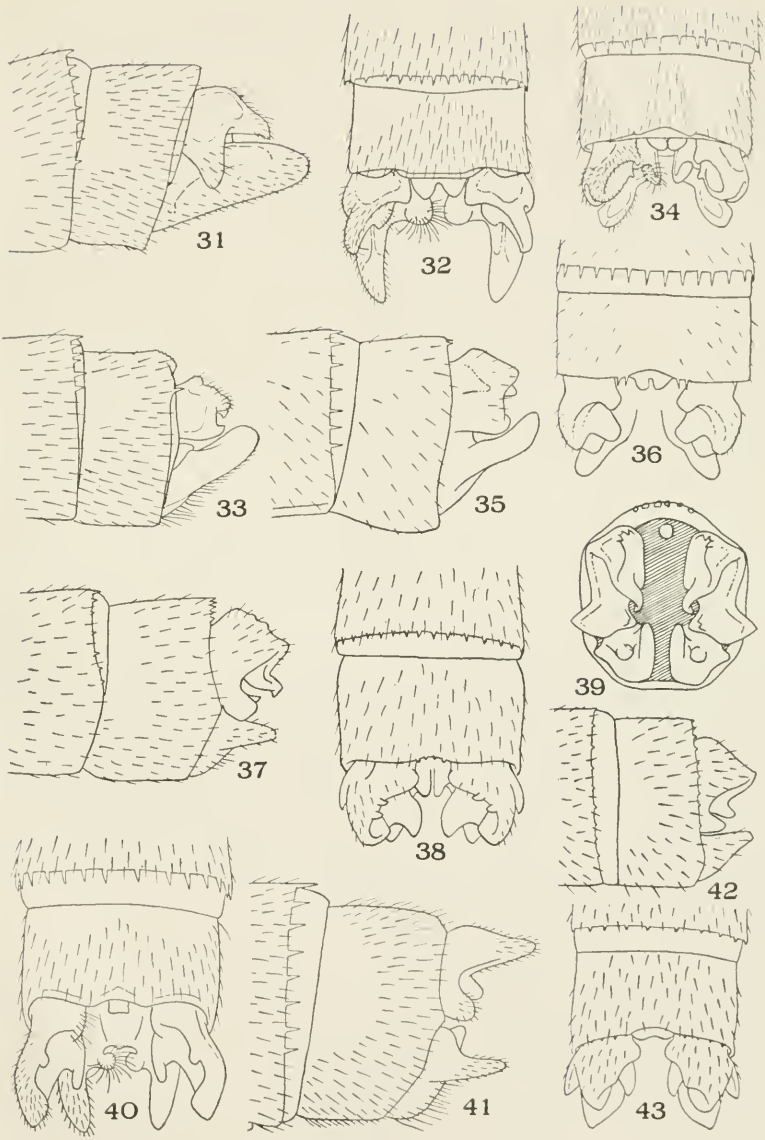


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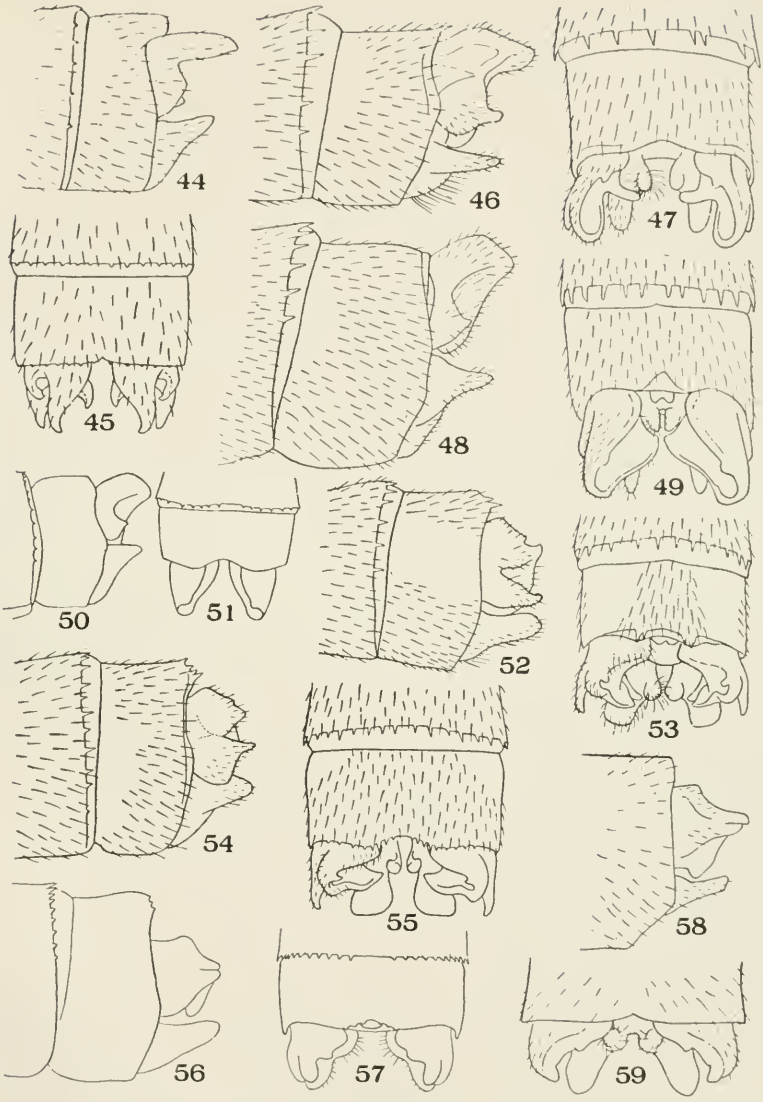


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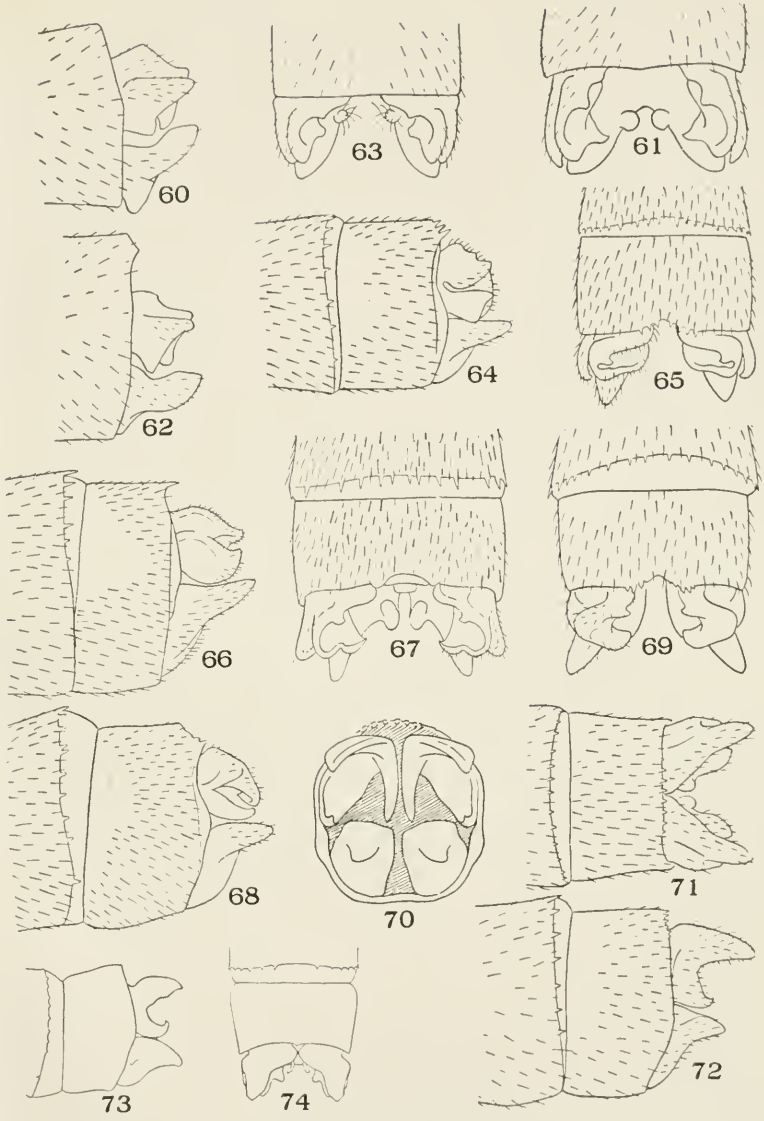


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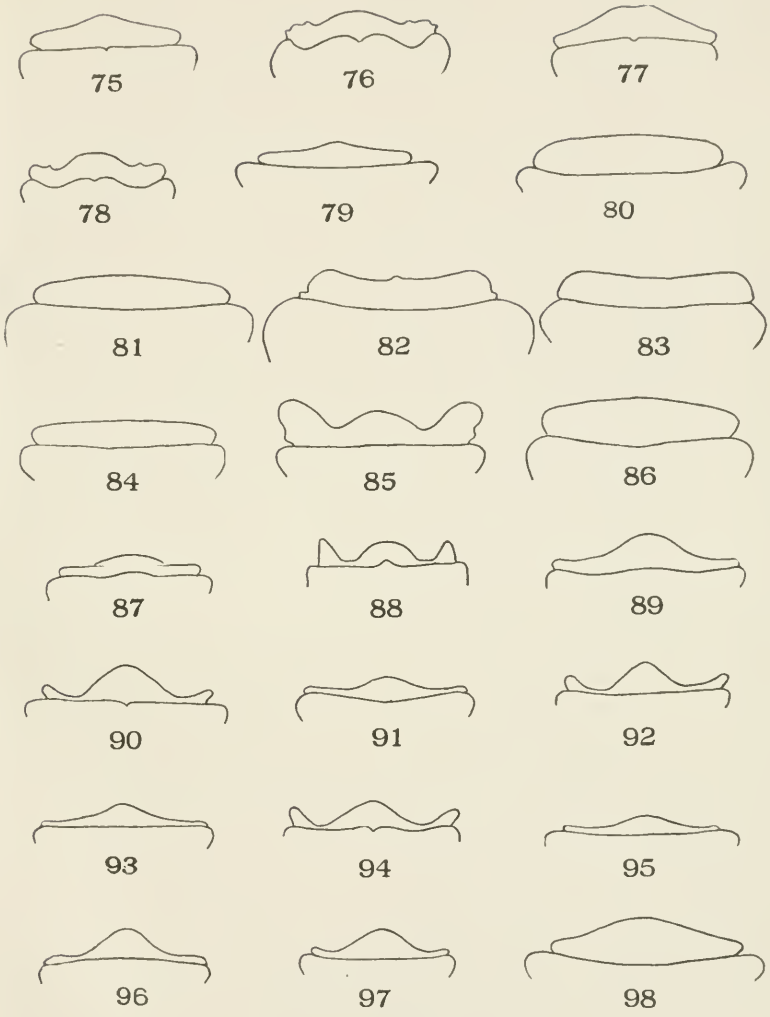


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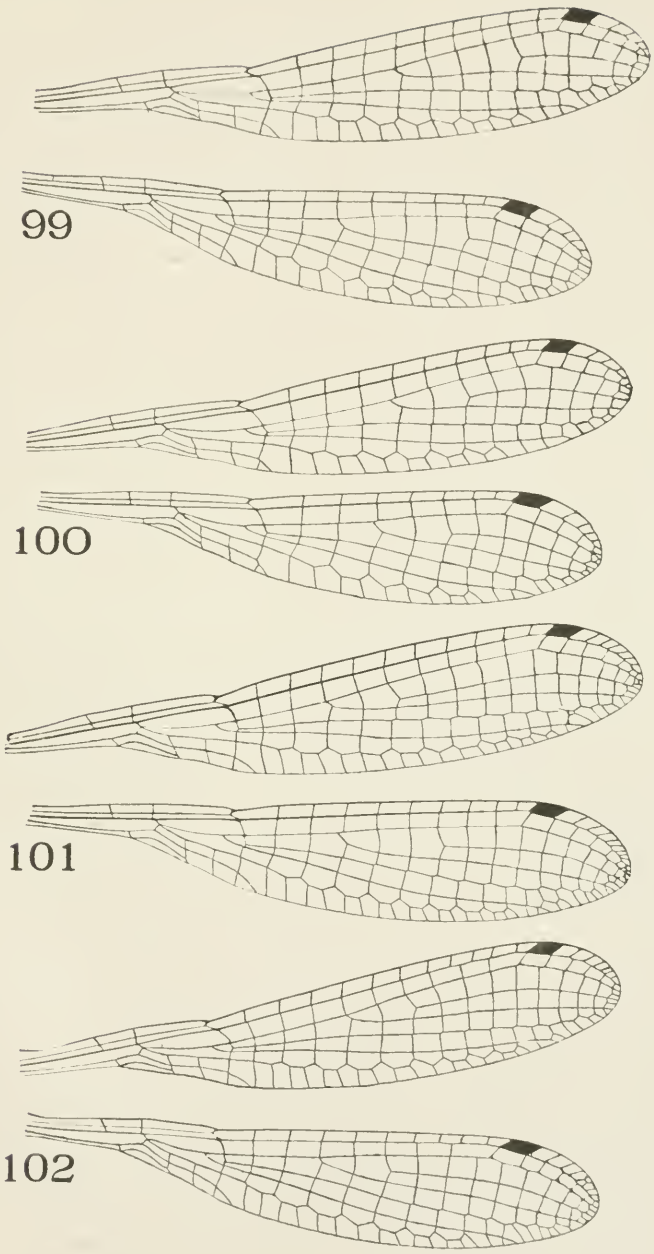


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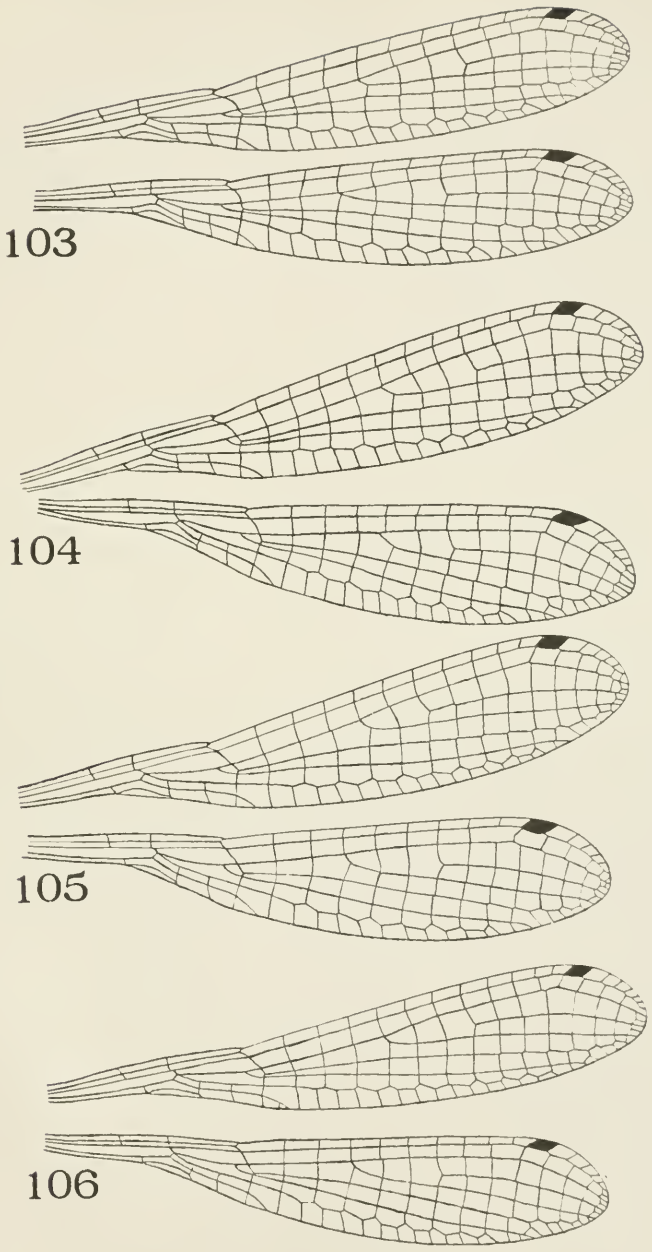


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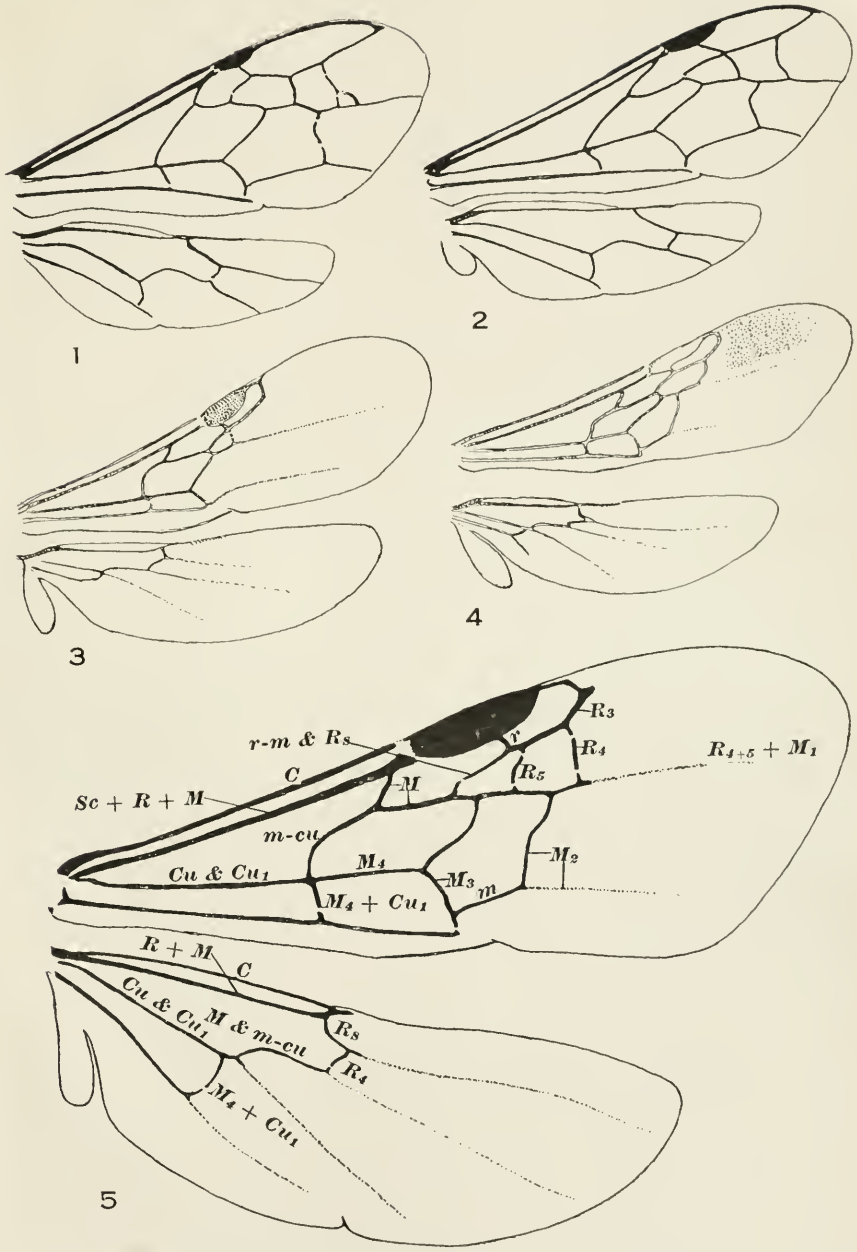
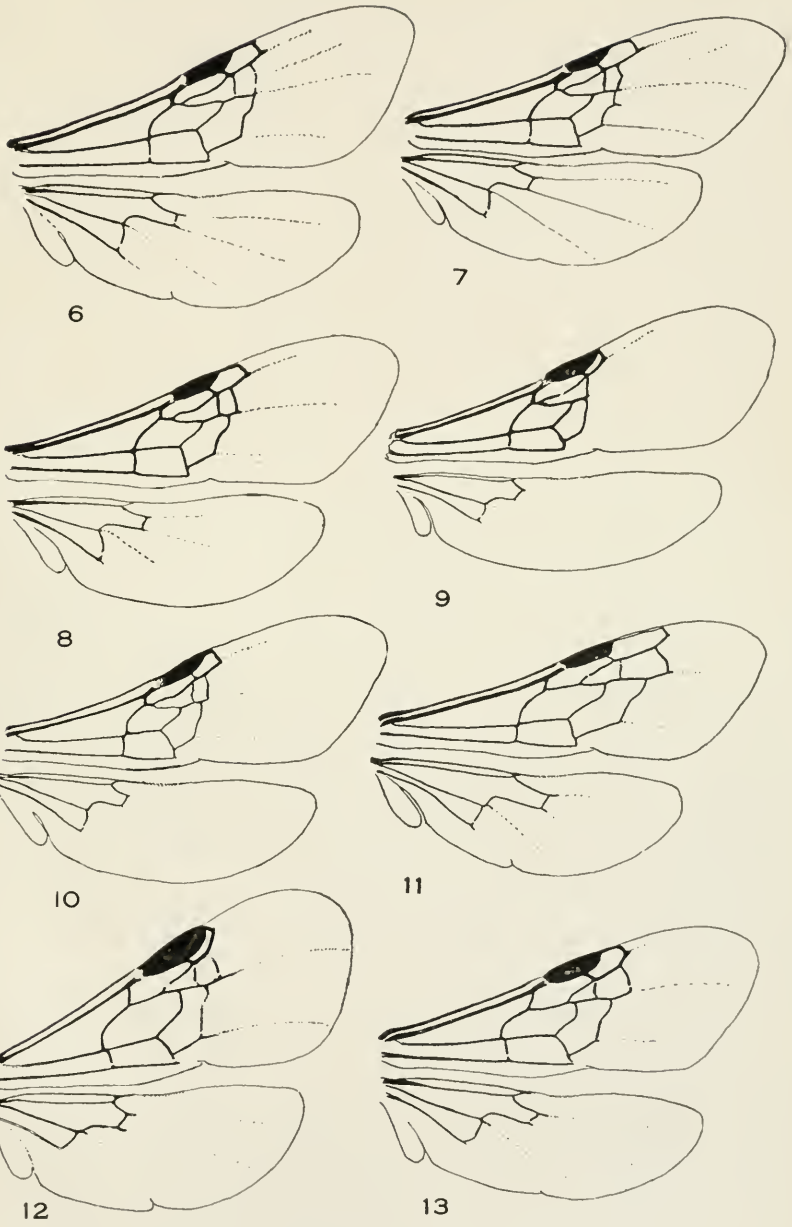



BRADLEY—NORTH AMERICAN MYRMOSIDAE

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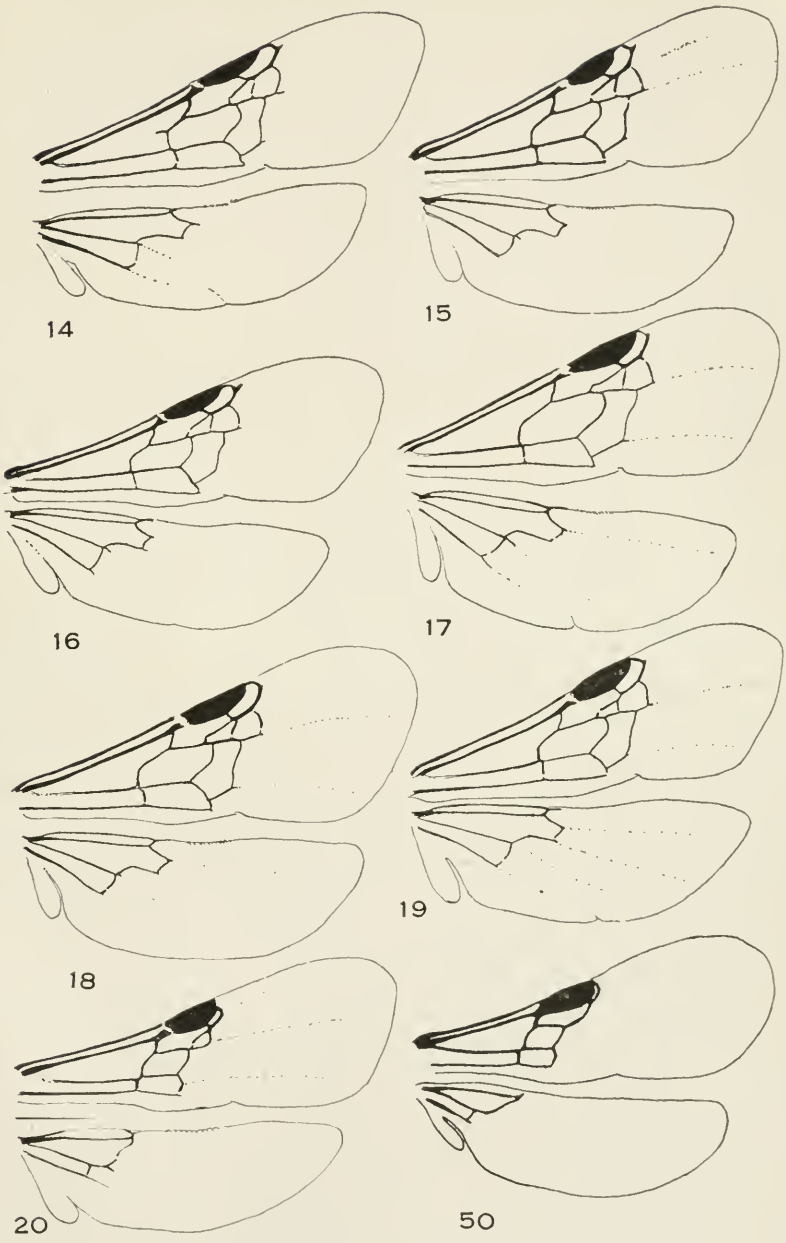


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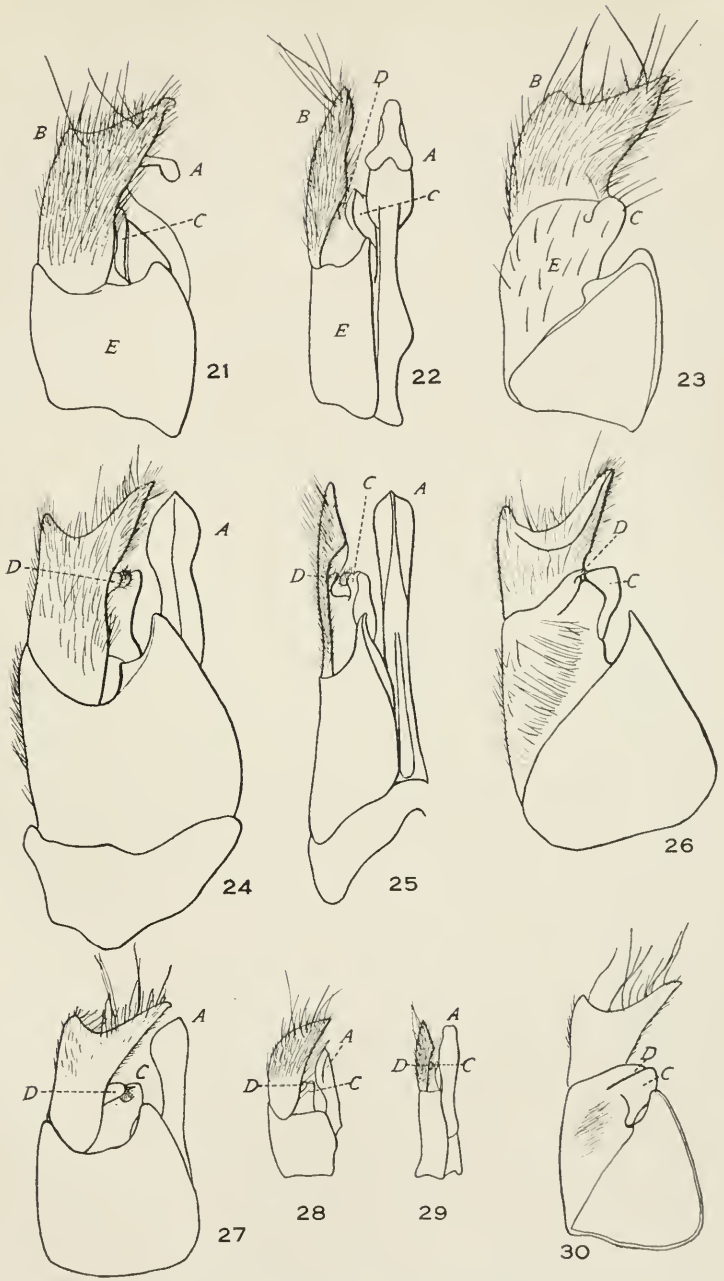


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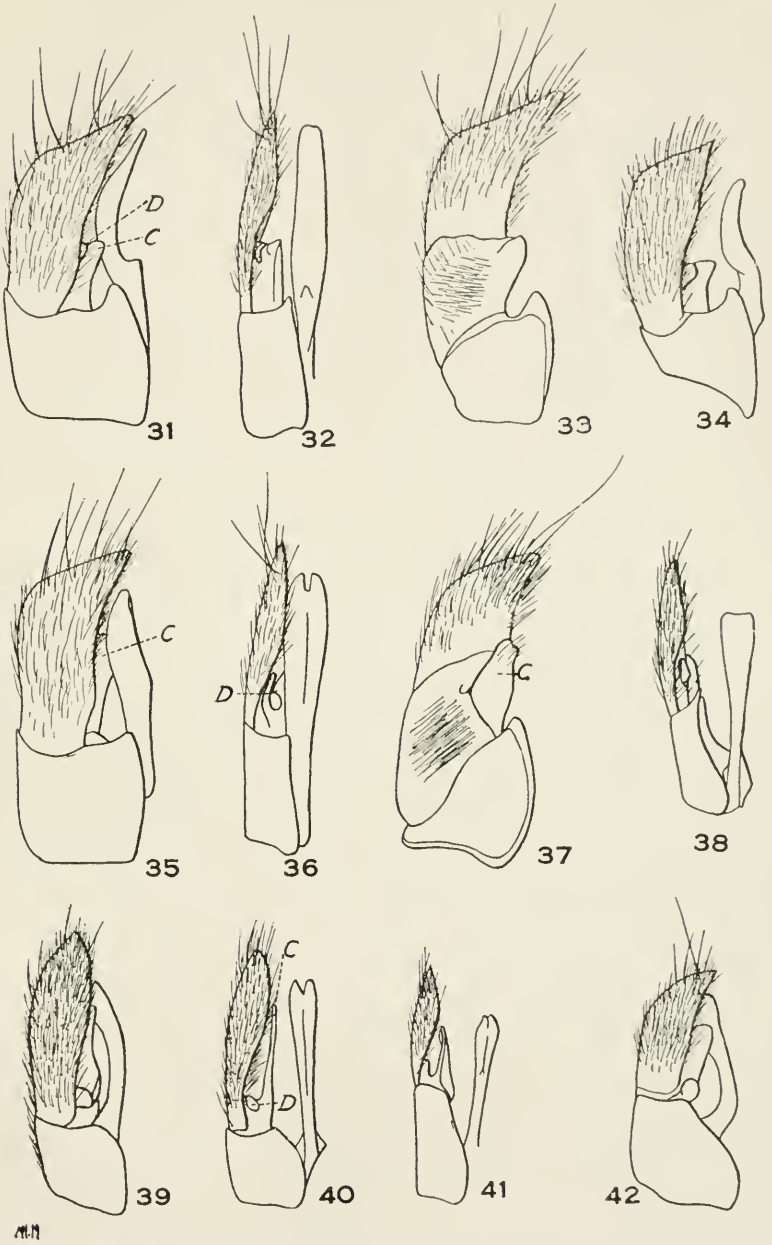
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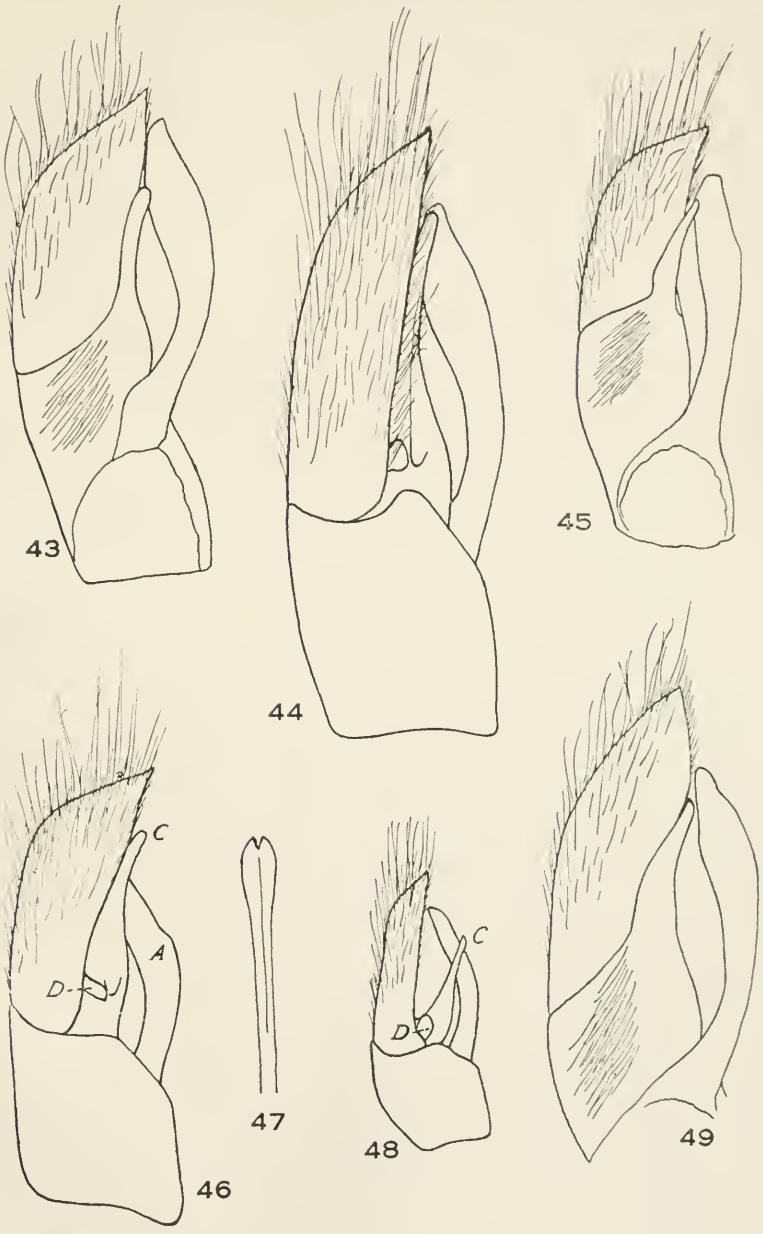


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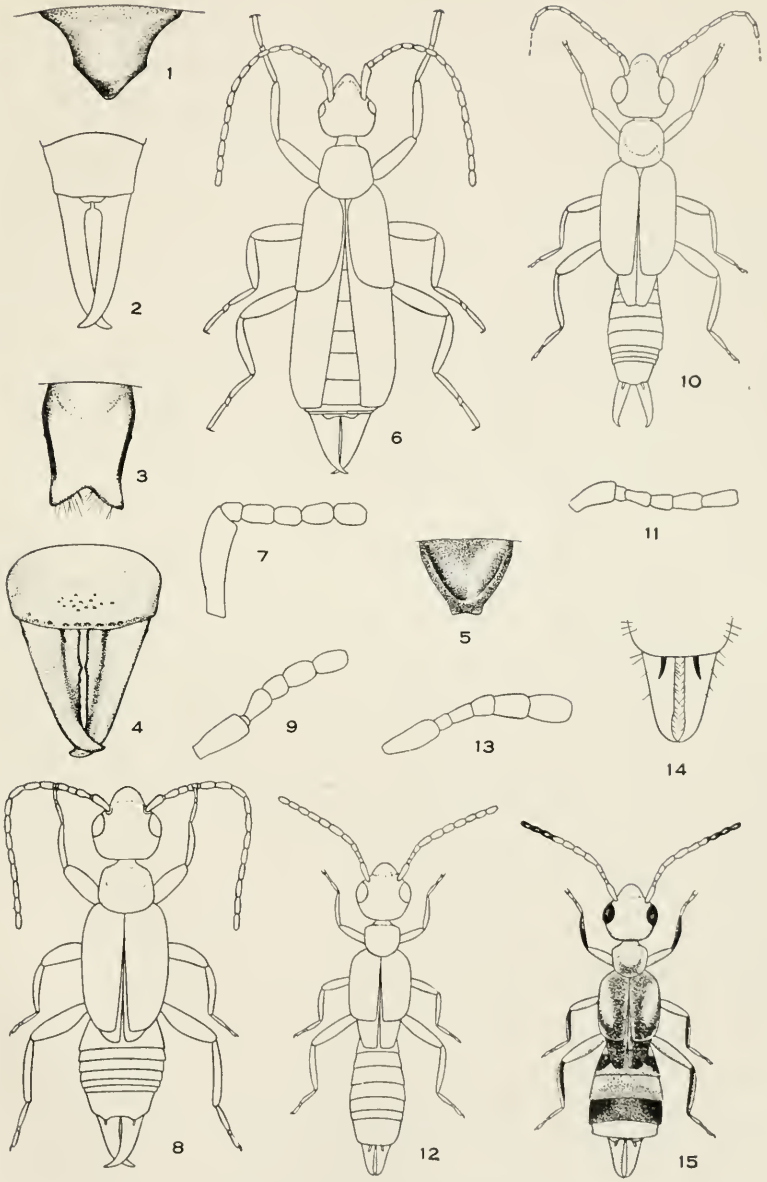


HEBARD—PANAMA DERMAPTERA

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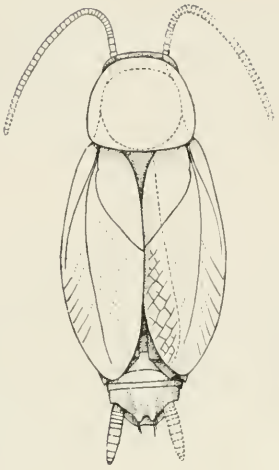

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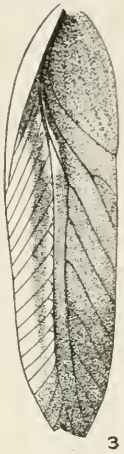

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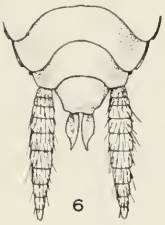

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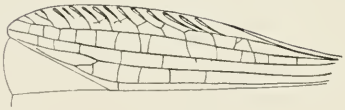

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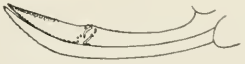

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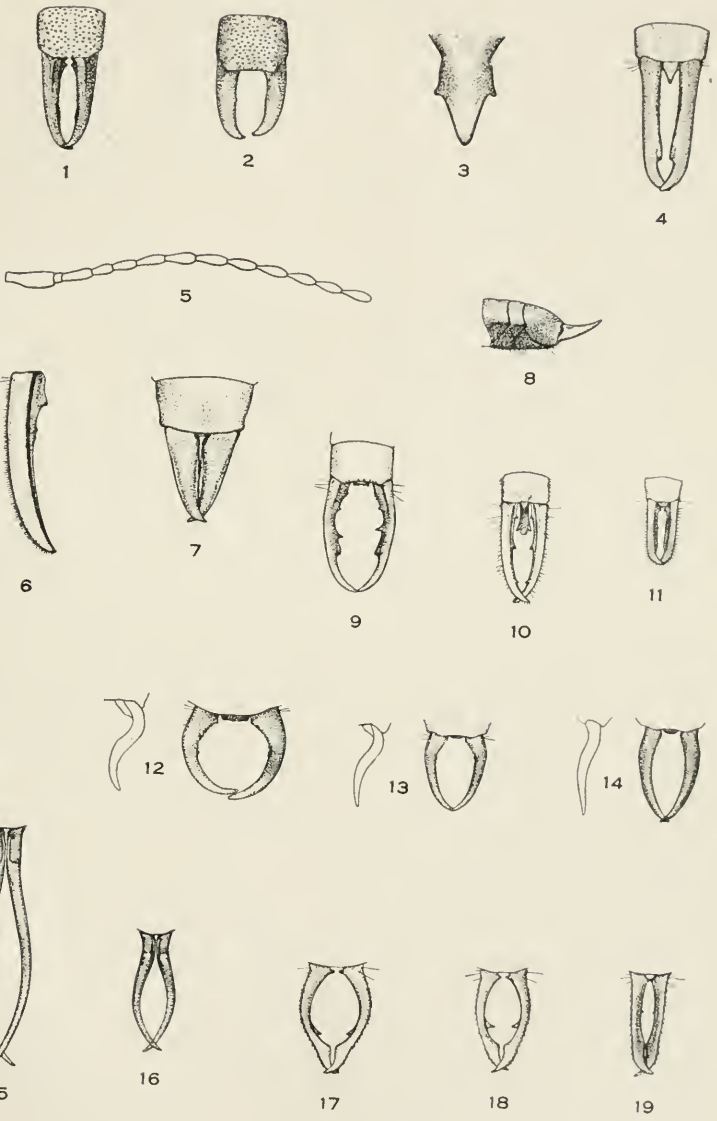
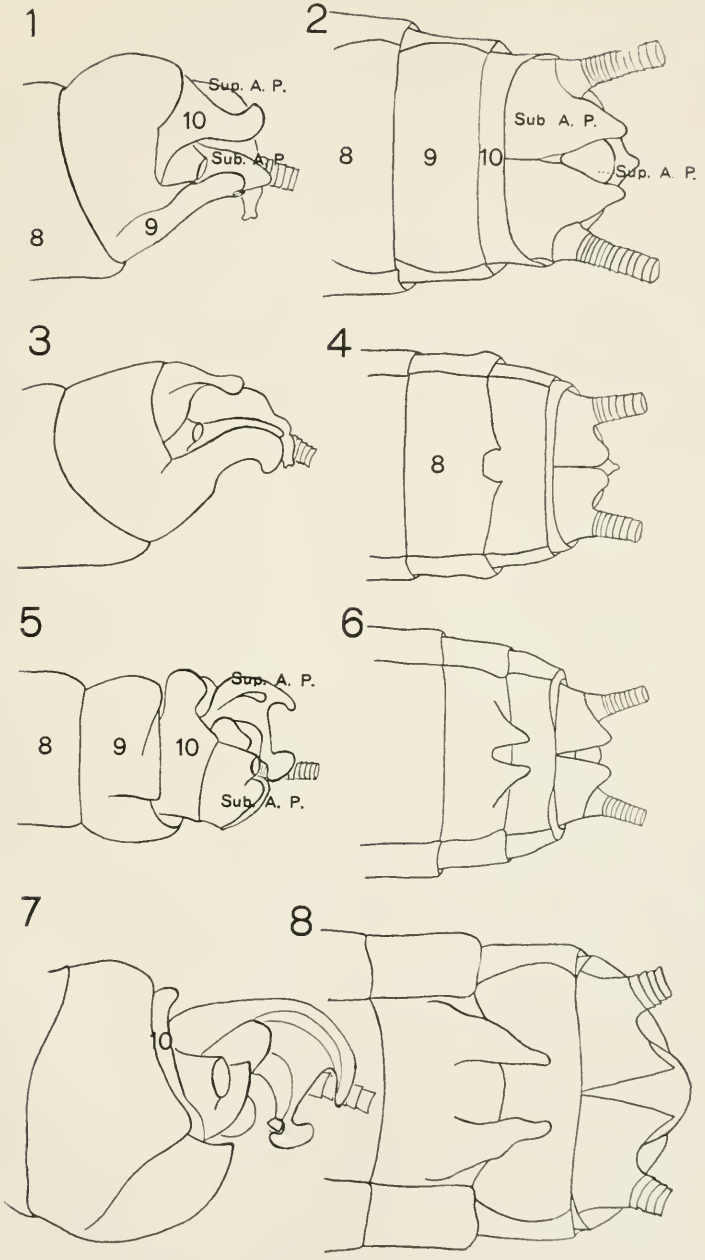
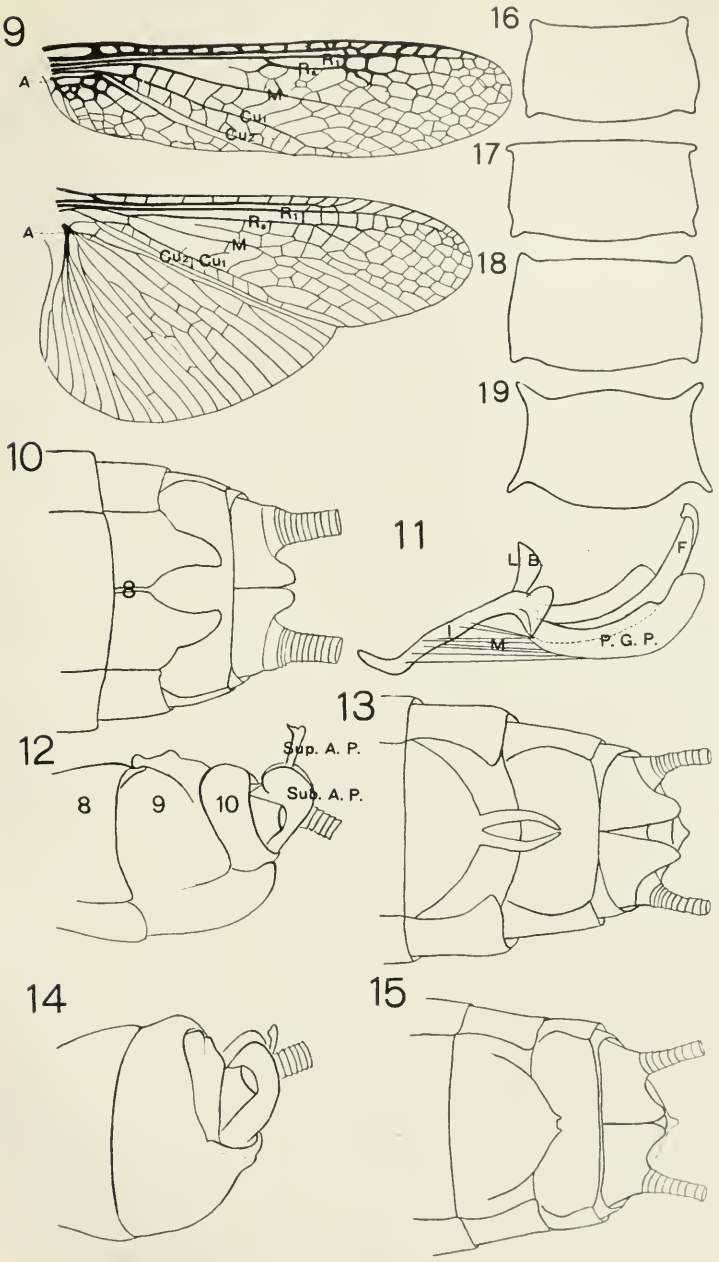



HEBARD—MEXICAN DERMAPTERA




SMITH—NORTH AMERICAN PLECOPTERA

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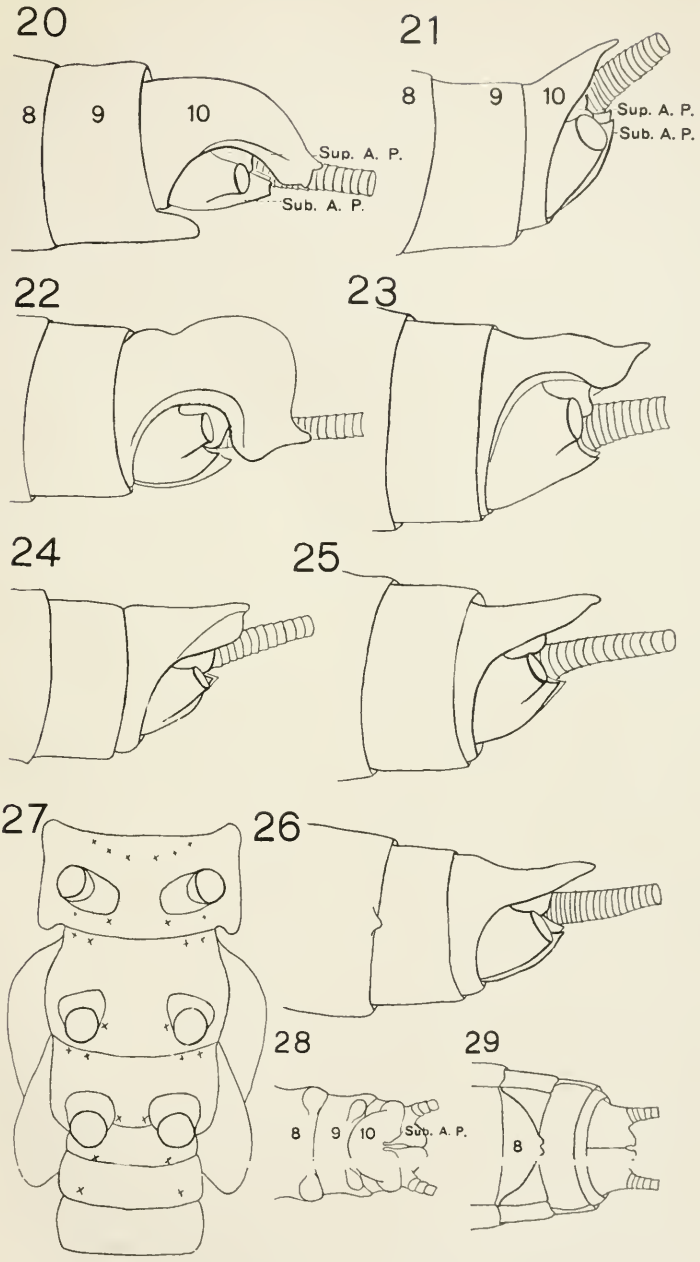


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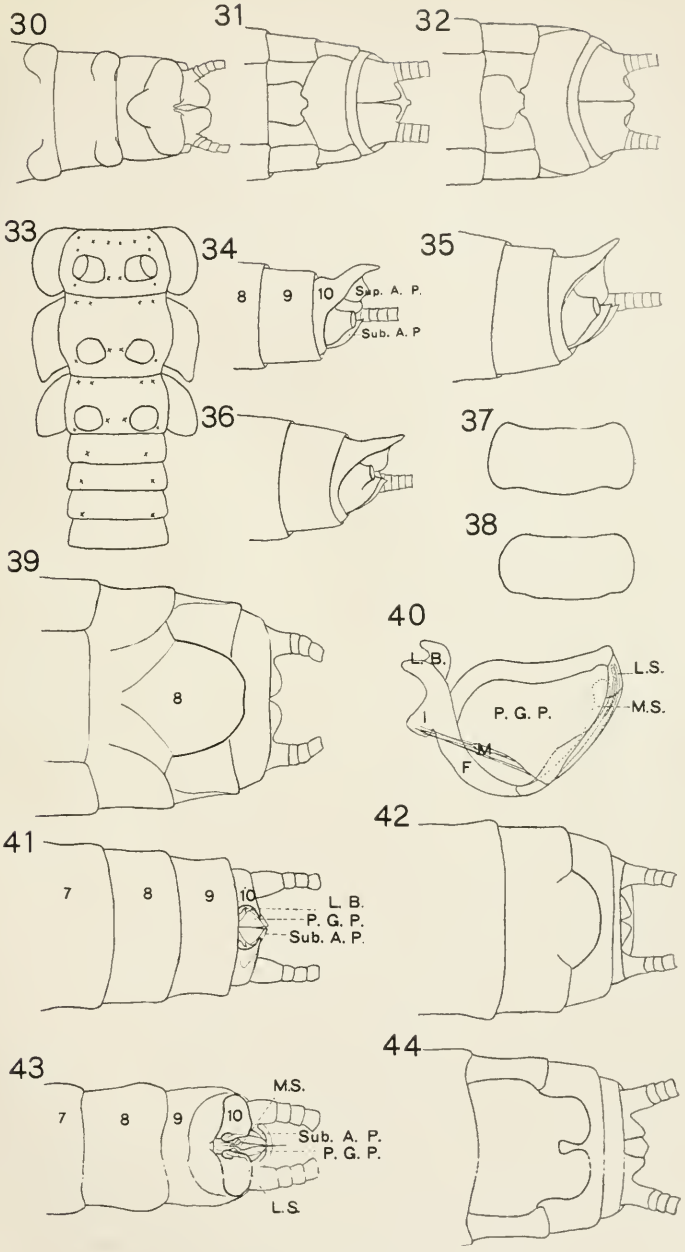


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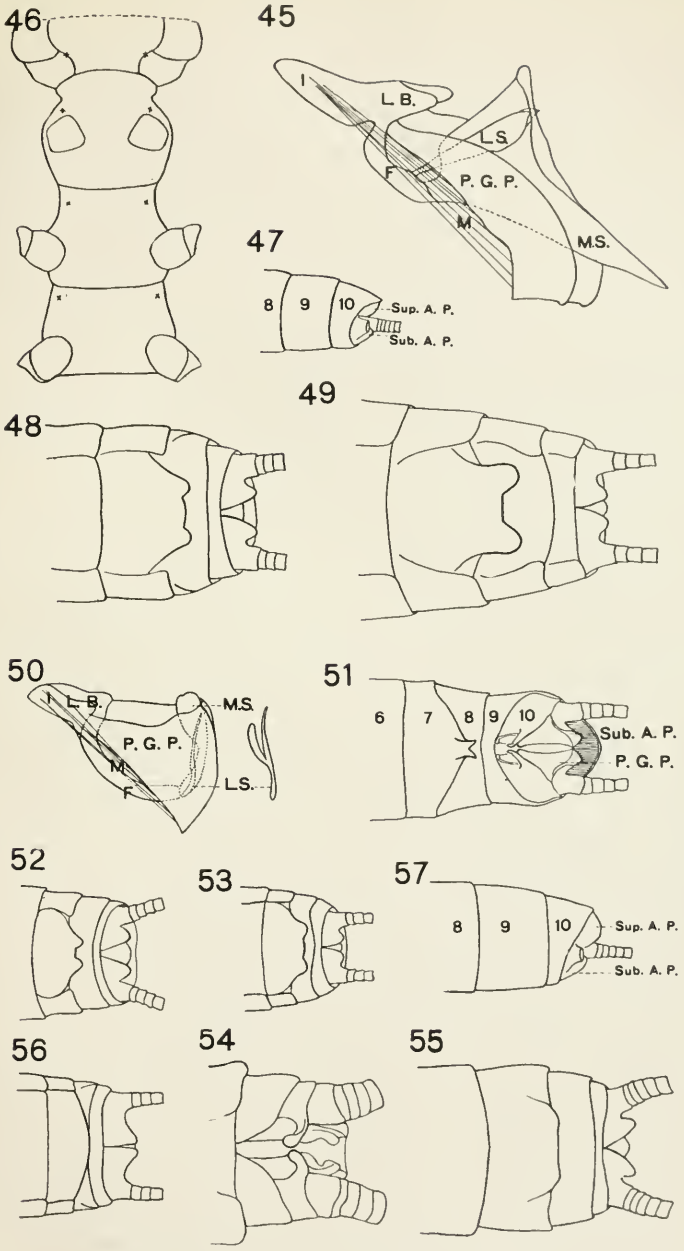


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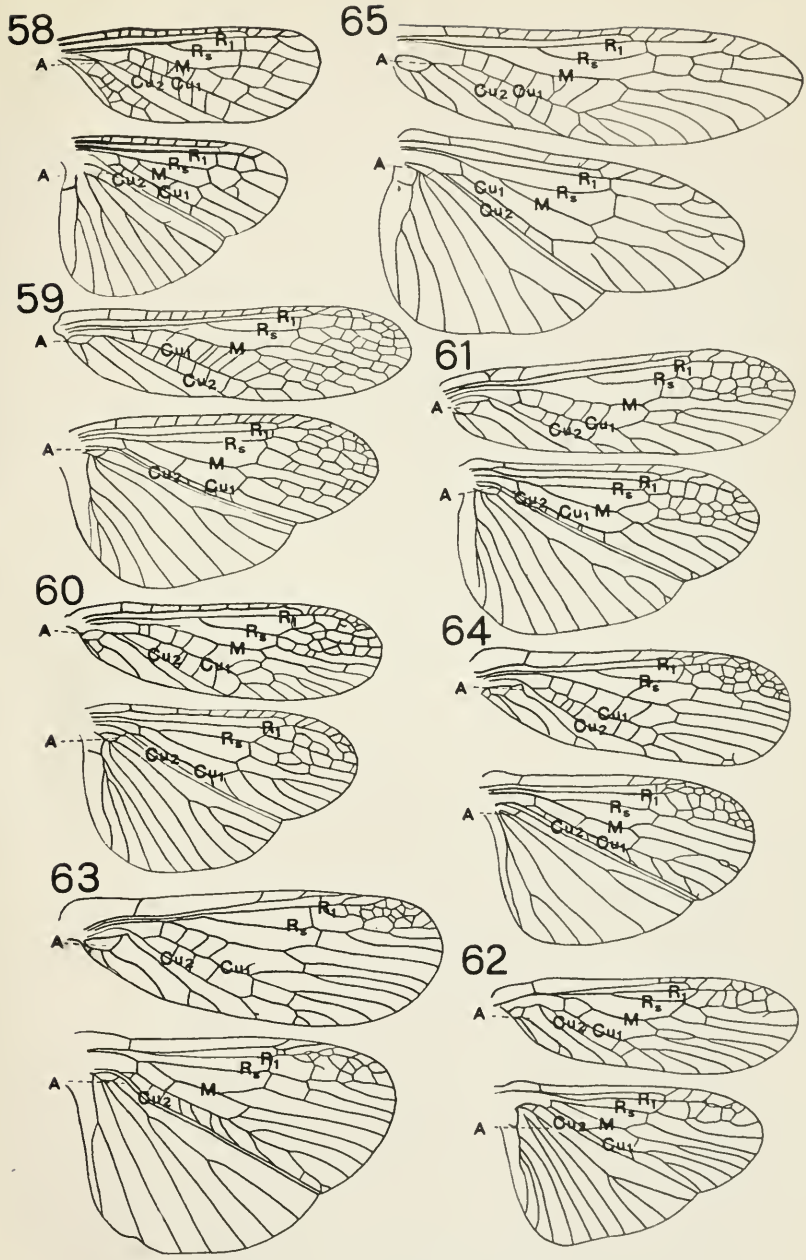


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